C

CANADIAN SEED GROWERS' ASSOCIATION

REPORT

OF

FIFTH ANNUAL MEETING

HELD AT

OTTAWA, FEBRUARY 4TH AND 5TH

1909

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PART I.—MINUTES

PART II.—PAPERS AND ADDRESSES PRESENTED

OTTAWA
GOVERNMENT PRINTING BUREAU
1909

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CANADIAN SEED GROWERS' ASSOCIATION

HEAD OFFICE: CANADIAN BUILDING, OTTAWA, ONT.

OFFICERS, 1909.

President.—Jas. W. Robertson, C.M.G., Macdonald College, Que.

Vice-Presidents.—Prof. C. A. Zavitz, Guelph, Ont.; Messrs. G. A. Gigault, Deputy Minister of Agriculture, Quebec, Que.; John Mooney, Regina, Sask.

Secretary and Treasurer.—L. H. Newman, B.S.A., Canadian Building, Ottawa, Ont.

Executive Council.—Dr. Jas. W. Robertson, L. H. Newman, Prof. C. A. Zavitz, W. L. Davidson, Davidson's Hill, Que.; G. A. Gigault, Prof. L. S. Klinck, Macdonald College, Que.; Jno. Bracken, B.S.A., Sup't. Fairs and Institutes, Regina, Sask.

Directors.—Prof. C. A. Zavitz; Messrs. Thos. A. Peters, Deputy Minister of Agriculture, Fredericton, N.B.; G. A. Gigault; Thos. H. Woolford, Cardston, Alta.; Jno. Bracken; W. L. Davidson; Hon. W. R. Motherwell, Minister of Agriculture, Regina, Sask.; Thos. S. Waugh, North Bedeque, P.E.I.; J. O. Duke, Olinda, Ont.; John Mooney; Prof. M. Cumming, Truro, N.S.; Geo. Harcourt, Deputy Minister of Agriculture, Edmonton, Alta.; J. W. Wheaton, Toronto, Ont.; Geo. Batho, Winnipeg; Man.; Prof. W. J. Black, M.A.C., Winnipeg, Man.; Wm. Thompson, London, Ont.; Theodore Ross, Charlottetown, P.E.I.; Prof. L. S. Klinck; Donald Innes, Tobique River, N.B., and Wm. Ballantyne, Stratford, Ont.

Auditors.—L. S. Klinck, Macdonald College, Que.; Accountant, Department of Agriculture, Ottawa, Ont

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CANADIAN SEED GROWERS' ASSOCIATION

HEAD OFFICE: CANADIAN BUILDING, OTTAWA, ONT.

LIST OF OPERATING MEMBERS, 1908.

The following list gives the names and addresses of the members from whom satisfactory reports were received for 1908, together with the kinds and varieties of crops with which they are operating, and the number of consecutive years which the seed has been selected:—

WHEAT.

Alberta.

Abel, J. H., Lloydminster, Sec. 30, Tp. 49, R. 1, W. 4th Mer.; Red Fife, 1 year.
Hecko, Peter, Clover Bar, Sec. 20, Tp 53, R. 23, W. 4th Mer.; Red Fife, 1 year.
Pawson, W. H., Coaldale, Sec. 1, Tp. 9, R. 20, W. 4th Mer.; Red Fife, 2 years.
Woolford, Thos. H., Cardston, Sec. 9, Tp. 3, R. 25, W. 4th Mer.; Turkey Red, 2 years.

Saskatchewan.

Black, W. M., Creelman, Sec. 9, Tp. 10, R. 10, W. 2nd Mer.; Red Fife, 5 years.
Coles, F. Moffat, Sec. 36, Tp. 15, R. 10, W. 2nd Mer.; Preston, 5 years.
Dash, F. J., Hillesden, Sec. 22, Tp. 15, R. 6, W. 2nd Mer.; Red Fife, 8 years.
Dunbabin, T. W., Craik, Sec. 32, Tp. 24, R. 28, W. 2nd Mer.; Red Fife, 1 year.
Eakin, Wm., Eakindale, Sec. 12, Tp. 23, R. 3, W. 2nd Mer.; Red Fife, 1 year.
Howard Bros., Forest Farm, Sec. 27, Tp. 17, R. 2, W. 2nd Mer.; White Fife.
Hampton, S. W., Graytown, Sec. 30, Tp. 12, R. 7, W. 2nd Mer.; Red Fife, 3 years.
Mooney, Jno., Regina, Red Fife, 6 years.
Ramsay, W. L. Bladworth, Sec. 6, Tp. 28, R. 1, W. 3rd Mer.; Preston.
Rigney, Jno. H., Wolseley, Sec. 5, Tp. 17, R. 9, W. 2nd Mer.; Red Fife, 2 years.
Royley-Noyes, R. J., Marshall, Sec. 4, Tp. 48, R. 27, W. 3rd Mer.; Red Fife, 2 years.
Smith, Geo. L., Saskatoon, Sec. 28, Tp. 36, R. 6, W. 3rd Mer.; Red Fife (Early str.), 1 year.
Saunders, W. J., Marshall, Sec. —, Tp. 48, R. 26, W. 3rd Mer.; Stanley, 1 year.
Scott, T. J., North Battleford, Preston, 2 years.
Telfer, Jno., South Melfort, Sec. 22, Tp. 44, R. 18, W. 2nd Mer., Red Fife, 1 year.

Manitoba.

Bradshaw, Geo. H., Morden, Sec. 3, Tp. 25, R. 6, W. Prin. Mer.; Red Fife, 2 years.
Bedford, E., Morden, Sec. 6, Tp. 2, R. 5, W. Prin. Mer., Red Fife.
Cooper, A., Treesbank, Sec. 2, Tp. 8, R. 16, W. Prin. Mer.; Red Fife, 2 years.
Dow Brothers, Gilbert Plains, Sec. 9, Tp. 25, R. 22, W. Prin. Mer.; Red Fife, 6 years.
Henderson, Austin F., Morden, Sec. 22, Tp. 3, R. 5, W. Prin. Mer.; White Fife, 1 year.
Hutchinson, J. T., Hayfield, Sec. 28, Tp. 8, R. 19, W. Prin. Mer.; Red Fife, 1 year.

Henry, J. L., Beaver, Sec. 36, Tp. 12, R. 10, W. Prin. Mer.; Red Fife, 2 years.
Lumb Bros., Cartwright, Sec. 19, Tp. 3, R. 14, W. Prin. Mer.; Red Fife, 6 years.
Paterson, David, Berton, Sec. —, Tp. 12, R. 12, W. Prin. Mer.; Red Fife, 2 years.
Rowe, W. A. A., Neepawa, Sec. 25, Tp. 15, R. 16, W. Prin. Mer.; Red Fife, 2 years.
Smith, J. C., Darlingford, Sec. 17, Tp. 2, R. 7, W. Prin. Mer.; Red Fife. 1 year.
Thomson, Thos., Roden, Sec. 22, Tp. 11, R. 22, W. Prin. Mer.; Red Fife, 9 years.
Turnbull, T., Manitou, Sec. 35, Tp. 3, R. 9, W. Prin. Mer.; Red Fife, 6 years.
Wight, Gus., Napinka, Sec. 20, Tp. 4, R. 25, W. Prin. Mer.; Red Fife, 2 years.
Webb, H. K., Swan River, Sec. 34, Tp. 36, R. 27, W. Prin. Mer.; Stanley, 2 years.
Yeomans, G. M., Alexander, Sec. 17, Tp. 10, R. 21, W. Prin. Mer.; Red Fife.
Yeomans, G. M., Alexander, Sec. 17, Tp. 10, R. 21, W. Prin. Mer.; Preston.

Ontario.

Davidson, H., Mt. Nemo, Halton County; Early Red Clawson, 5 years.
Gies, C. R., Heidelberg, Waterloo County; Dawson's Golden Chaff, 9 years.
McKay, Robert, Maxville, Glengarry County, Red Fife, 8 years.
McCallum, Jno., Shakespeare, Perth County, Abundance, 3 years.

Quebec.

Davidson, W. L., Davidson's Hill, Shefford County; White Fife, 5 years.
Davidson, W. L., Davidson's Hill, Shefford County; Red Fife, 2 years.
Gobiel, Adelard, Rivière du Moulin, Chicoutimi County; Red Fife, 6 years.
Levasseur, Jérémie, Tessierville, Rimouski County; Campbell's W. Chaff, 9 years.
Perron, Jos., Les Eboulements, Charlevoix County; Perron, 9 years.
Tremblay, A. (fils d'Arsène), Chicoutimi, Chicoutimi County; Red Fife, 6 years.

New Brunswick.

Innes, Donald, Tobique River, Victoria County; White Fife, 9 years.

Nova Scotia.

Eadie, Harry, Antigonish, Antigonish County; Red Fife, 3 years.
McKay, Robert, Millsville, Pictou County; Red Fife, 9 years.
Mackay, Robt. D., Balmoral Mills, Colchester County; Red Fife, 2 years.

Prince Edward Island.

Arsenault, Elie E., Urbinville, Prince County, White Russian, 3 years.
Creed, R., Albion, Lot 59, King's County, White Russian, 2 years.
McMillan, Gordon, New Haven, Queen's County, White Fife, 9 years.
Marchbank, Percy, New Annan, Prince County, White Fife, 2 years.
Waugh, Thos., North Bedeque, Prince County; White Russian, 9 years.
Wigginton, T. J., Bridgetown, King's County, White Russian, 9 years.

OATS.

Alberta.

Pawson, W. H., Coaldale, Sec. 1, Tp. 9, R. 20, W. 4th Mer.; Banner, 1 year.

Saskatchewan.

Black, W. M., Creelman, Sec. 9, Tp. 10, R. 10, W. 2nd Mer.; Banner, 1 year.
Carter, R. H., Fort Qu'Appelle, Sec. 17, Tp. 21, R. 14, W. 2nd Mer.; Abundance (Eng.), 1 year.
Dixon, W. L., Battleford, Sec. 20, Tp. 37, R. 21, W. 3rd Mer.; Banner, 8 years.
Gwillim, Arthur, Churchbridge, Sec. 36, Tp. 21, R. 33, W. Prin. Mer.; Banner, 1 year.

Manitoba.

Bradshaw, Geo. H., Morden, Sec. 3, Tp. 25, R. 6, W. Prin. Mer.; Banner, 2 years.
Cooper, A., Treesbank, Sec 2, Tp. 8, R. 16, W. Prin. Mer.; Banner, 1 year.
Collis, W. R. F., Shoal Lake, Sec. 30, Tp. 16, R. 24, W. Prin. Mer.; Abundance (Eng.), 1 year.
Dow Bros., Gilbert Plains, Sec. 9, Tp. 25, R. 22, W. Prin. Mer.; Banner, 8 years.
Hutchinson, T. J., Hayfield, Sec 28, Tp. 8, R. 19, W. Prin. Mer.; Abundance (Eng.), 1 year.
Lumb Bros., Cartwright, Sec. 19, Tp. 3, R. 14, W. Prin. Mer.; Abundance (Can.), 1 year.
Lumb Bros., Cartwright, Sec. 19, Tp. 3, R. 14, W. Prin. Mer.; Banner, 3 years.

Ontario.

Boyce, Geo., Merivale, Carleton County; Banner, 8 years.
Carmichael, Duncan, Jr., West Lorne, Elgin County, Ligowo, 4 years.
Carmichael, Duncan, Jr., West Lorne, Elgin County, White Lothian, 1 year.
Gies, C. R., Heidelberg, Waterloo County, Newmarket, 6 years.
Hyde, David W., Shakespeare, Perth County; Banner, 1 year.
Hunter, Jno., Wyoming, Lambton County, Poland White, 1 year.
Lewis, Wm., Dunsford, Victoria County; Siberian, 1 year.
Livingston, Lloyd, Minesing, Simcoe County; Banner, 1 year.
Nicholson, Chester, Mt. Forest, Grey County; Banner, 2 years.
Prouse, David, Goderich, Huron County; Newmarket, 9 years.
Ramage, W., Thistle, Grey County; Tartar King, 5 years.
Stark, J. H., Lang, Peterborough County; Tartar King, 1 year.

Quebec.

Bélanger, Cyprien, Trois-Pistoles, Témiscouata County; Tartar King, 9 years
Cloutier, M. St. Pierre, Montmagny County; Banner, 1 year.
Davidson, W. L., Davidson's Hill, Shefford County; Banner, 5 years.
Gagné, Jos., L'Islet Station, L'Islet County, Waverley.
Lafrenaie, S., St. Jude, St. Hyacinthe County; Banner, 3 years.
Levasseur, J., Tessierville, Rimouski County; Tartar King.
Levasseur, J., Tessierville, Rimouski County; Banner, 9 years.
Pintal, Gus., Champlain, Champlain County; Banner, 2 years.
Roy, N., Ste. Hénédine, Dorchester County; Banner, 4 years.

New Brunswick.

Ferguson, Jno., Lower Queensbury, York County; Early Triumph, 9 years.
Hastings, Chas., Murray Road, Westmoreland County; Black Island, 1 year.
Innes, Donald, Tobique River, Victoria County; Early Blossom, 9 years.
Moore, Wm. H., Scotch Lake, York County; Banner, 9 years.
Oastler, Jas. R., Minister's Island, Charlotte County; Banner, 2 years.
Palmer, Wm. E., Scotch Lake, York County; Banner, 2 years.

Nova Scotia.

Brown, Harry, Wallace Bay, Cumberland County; Banner, 6 years.
McKay, Robert, Millsville, Pictou County; Manitoba, 8 years.
Mackay, Robt. D., Balmoral Mills, Colchester County; Banner, 2 years.
Wright, Wm. O., Dalhousie East, King's County; American Beauty, 6 years.

Prince Edward Island.

Arsenault, Elie E., Urbinville, Prince County; Old Island Black, 1 year.
Creed, Richard, Albion, King's County; Twentieth Century, 1 year.

Creed, Richard, Albion, King's County; White Egyptian, 9 years.
Marchbank, Jas., New Annan, Prince County; Black Tartarian, 9 years.
Marchbank, Jas., New Annan, Prince County; Banner, 9 years.
McKenna, Michael, Newton, Prince County; Banner, 9 years.
Rodd, Ira L., North Milton, Queen's County; Black Norway, 3 years.
Schurman, Wm. G., Ross' Corners, Prince County; English White Potato, 1 year.
Waugh, Thos., North Bedeque, Prince County; Banner, 6 years.
Wigginton, T. J., Bridgetown, King's County; White Egyptian, 1 year.

BARLEY.

Saskatchewan.

Black, W. M., Creelman, Sec. 9, Tp. 10, R. 10, W. 2nd Mer.; Mensury, 1 year.
Carter, R. H., Fort Qu'Appelle, Sec. 17, Tp. 21, R. 14, W. 2nd Mer.; 2 Rowed var., 1 year.
Carter, R. H., Fort Qu'Appelle, Sec. 17, Tp. 21, R. 14, W. 2nd Mer.; 6 Rowed var., 1 year.
Funk, Abr., Tiefengrund, Sec. 20, Tp. 44, R. 4, W. 3rd Mer.; Standwell, 1 year.

Manitoba.

Bradshaw, Geo. H., Morden, Sec. 3, Tp. 25, R. 6, W. Prin. Mer.; Mandscheuri, 3 years.
Cooper, A., Treesbank, Sec. 2, Tp. 8, R.. 16, W. Prin. Mer.; Mensury, 1 year.
Lumb Brothers, Cartwright, Sec 19, Tp. 3, R. 14, W. Prin. Mer.; Mensury, 3 years.

Ontario.

Carmichael, Duncan, West Lorne, Elgin County; Mensury, 6 years.
Carmichael, Duncan, West Lorne, Elgin County; Mandscheuri, 4 years.
Gies, C. R., Heidelberg, Waterloo County; Mandscheuri, 3 years.
Mackey, Chas., Kinsale, Ontario County; Mandscheuri, 6 years.
McCallum, Jno. M., Shakespeare, Perth County; No. 21, 2 years.
Nicholson, Chester, Mount Forest, Grey County; No. 21, 1 year.

Quebec.

Davidson, W. L., Davidson's Hill, Shefford County; Mensury, 5 years.

New Brunswick.

Innes, Donald, Tobique River, Victoria County; Mensury, 4 years.

Nova Scotia.

McKay, Robt., Millsville, Pictou County; Mensury, 2 years.

Prince Edward Island.

Creed, Richard, Albion, King's County; Mensury, 2 years.
Wigginton, T. J., Bridgetown, King's County; Mensury, 1 year.

INDIAN CORN.

Ontario.

Carmichael, D., Jr., West Lorne, Elgin County; Reid's Yellow Dent, 2 years.
Coatsworth, G. W. & Son, Kingsville, Essex County; Reid's Yellow Dent, 1 year.

Coatsworth, J. H., Ruthven, Essex County; Yellow Dent (Hybrid), 1 year.
Duke, J. O., Olinda, Essex County; Stowell's Evergreen, 5 years.
Hankinson, L., Grovesend, Elgin County; Yellow Flint (str.), 4 years.
Hunter, Jno., Wyoming, Lambton County; White Cap Yellow Dent, 1 year.
Maccoll, Arch., Aldboro, Elgin County; Reid's Yellow Dent, 1 year.
McKee, Jno., Norwich, Oxford County; Stowell's Evergreen, 2 years.
Pearce, Chas., Wellington, Prince Edward County; Stowell's Evergreen (early str.) 4 years.
Pearce, Jno. P., Staples, Essex County; Leaming, 2 years.
Smith, Edward, Ridgetown, Kent County; Compton's Early, 1 year.
Thompson, Robt. St. Catharines, Lincoln County; Salzer's North Dakota, 1 year.
Thomas, J. C., Blytheswood, Essex County; White Cap Y. Dent, 4 years.
Ure, Fred., Windsor, Essex County; Yellow Dent, 3 years.
Woodbridge, A. H., Kingsville, Essex County; Reid's Yellow Dent, 1 year.

Quebec.

Davidson, W. L., Davidson's Hill, Shefford County; Western Beauty, 4 years.
Lafrenaie, S., St. Jude, St. Hyacinthe County; Western Beauty, 2 years.

Nova Scotia.

Chute, Manning, Berwick, King's County; Native Yellow, 1 year.

PEASE.

New Brunswick.

Innes, Donald, Tobique River, Victoria County; White Marrowfat, 4 years.

Prince Edward Island.

Creed, Richard, Albion, King's County; White Marrowfat, 1 year.
Wigginton, T. J., Bridgetown, King's County; White Marrowfat, 1 year.

POTATOES.

Saskatchewan.

Saunders, W. J., Marshall, Sec. 22, Tp. 48, R. 26, W. 3rd Mer.; Up-to-date, 2 years.

Manitoba.

Orchard, Harold, Lintrathen, Sec. 4, Tp. 6, R. 6, W. Prin. Mer.; Honey Eye Rose, 3 years.
Orchard, Harold, Lintrathen, Sec. 4, Tp. 6, R. 6, W. Prin. Mer.; Sunrise, 2 years.

Ontario.

Canning, Robt., Hagerman, York County; Carman No. 1, 1 year.
Canning, Robt., Hagerman, York County; Vermont Gold Coin, 1 year.
Hutchinson, Alfred, Mount Forest, Wellington County; Empire State, 2 years.
Keys, Alex. J., Washburn, Frontenac County; Dibble's Favorite, 1 year.
Macoun, W. T. Experimental Farm, Ottawa; Carman No. 1, 1 year.

Quebec.

Lafrenaie, S., St. Jude, St. Hyacinthe County; Rural New Yorker, 1 year.
Taylor, Wm. H., St. Giles, Lotbinière County; Sensation, 1 year.
Taylor, Wm. H., St. Giles, Lotbinière County; Pond's Seedling, 1 year.

New Brunswick.

Oastler, Jas. R., Minister's Island, Charlotte County; Perfection, 2 years.

Nova Scotia.

Brown, Harry R., Wallace Bay, Cumberland County; Green Mountain, 3 years.
McKay, Robt., Millsville, Pictou County; Beauty of Hebron, 1 year.

Prince Edward Island.

Creed, Richard, Albion, King's County; Early Harvest, 2 years.
Wigginton, T. J., Bridgetown, King's County; McIntyre, 1 year.

PART I.

MINUTES OF FIFTH ANNUAL MEETING OF THE CANADIAN SEED GROWERS' ASSOCIATION.

The opening meeting of the Association was called to order at 2 p.m., February 4, 1909. At the request of Vice-President Gigault, who did not care to act as Chairman in the absence of the President before an English-speaking audience, Mr. Geo. H. Clark, Seed Commissioner, was elected to preside.

Mr. Clark.—I am sure I shall be expressing the sentiments of all who are here when I say we are exceedingly sorry that Dr. Robertson has not been able to be with us this afternoon. The first Vice-President, Prof. Zavitz, will also be unable to reach here until this evening. I now declare the annual meeting of the Association open for business. The first order of business on the program is the reading and disposal of the minutes of the last meeting. I am reminded by the Secretary that the minutes of the fourth annual convention have been printed and distributed to members throughout Canada.

Moved by Prof. Klinck, seconded by Mr. Campbell, that the minutes be taken as read.—Carried.

The Chairman.—The next order of business is the reading and disposal of communications. I am advised by the Secretary that there are no communications to present to the meeting except a number of expressions of regret from certain officers and members who found it impossible to attend.

We will now have the report of the Board of Directors of this Association.

REPORT OF THE BOARD OF DIRECTORS.

Presented by the Secretary.

Mr. President and Gentlemen,—Your Directors beg to report that the past Association year has been a successful and prosperous one. Not only has there been a gradual increase in the number of growers who have affiliated themselves with the Association, but there have been many evidences of the healthy effects which are being created by the application of those principles which are being so widely demonstrated throughout the country. Full details as to the exact standing of the Association will be given in the report of the Secretary-Treasurer.

A meeting of the Board was held this morning and the following recommendations prepared for presentation before this meeting:

1. That the annual meetings which are now held or which may be held in the various districts into which Canada has been divided and which heretofore have offered a medium through which subjects of vital interest to the grower might be discussed, be allowed to deal formally with any matters of business which may concern the members in the respective districts and that the place for the holding of these meetings be left to the discretion of the Executive Council.

2. That the Constitution be amended so that seed produced according to a system having for its basis the selection of individual plants as foundation stock may be given recognition by our Association. It was suggested further that this matter be dealt with later when the President and Prof. Zavitz will be present.

3. That application be made by the Association to the Department in the usual way for funds to enable it to carry on its work during the coming Association year.

4. That application be made to the Department to print the 5th annual report of the Association.

5. The advisability of taking action in encouraging the growing of root seeds in Canada was discussed at length and the following recommendation prepared:—'Your Directors recommend that in the absence of definite information regarding the production of home-grown root seeds and their relative value compared with the imported seeds, more extensive experiments be conducted at the various Experiment Stations in Canada with a view to obtaining authoritative information bearing upon this subject.'

6. Your Board also recommends that a resolution of appreciation be drafted and forwarded to the Canadian Pacific Railway and to the Canadian Northern Railway, Winnipeg, Man., for the assistance rendered the Association by way of granting special transportation to its secretary while this officer was on a tour of inspection in the West during the past season.

7. That a resolution of appreciation be forwarded Mr. F. T. Griffin, Land Commissioner, Canadian Pacific Railway, Winnipeg, for prizes given for specially selected seed grain in Manitoba and in Saskatchewan.

8. That the thanks of the Association be tendered the Eastern Canadian Passenger Association for offering special rates to this Convention.

The Chairman.—You have heard the report of the Board of Directors as read by the Secretary. What is the pleasure of the Association in respect to that report?

Moved by Mr. Raynor, seconded by Mr. Davidson, that the report of the Board of Directors be received and the various matters considered by this Association seriatum. —Carried.

The Chairman.—The first item for the consideration of this Association refers to the holding of a business session in connection with the informal conferences of members of the Association now held annually in some of the different districts. Perhaps, I might explain that at the Provincial Winter Fairs, such as are now held at Guelph, Ont., and at Amherst, N.S., there are held exhibitions of registered seed for which the Association provides substantial prizes. These exhibits, produced by members of the Association and brought into competition at these provincial exhibitions, naturally bring together quite a number of members who cannot very well attend the annual meeting as we have it here to-day. It is recommended by the Board that the Association place itself on record as favouring the plan of holding these informal conferences and also giving the members of the Association so congregated an opportunity to express their opinions, and to make any recommendation which they may choose for the consideration of this Association. What is the pleasure of the meeting in respect to this matter?

Mr. Raynor.—I think this is a very good proposal indeed. It furnishes an opportunity for a larger number of members to participate in the affairs of the Association. Part of the program of these Winter Fairs deals with the matter of seeds, and there is no apparent reason why the members of this Association should not be given an opportunity to discuss matters pertaining to their special work, and make suggestions or recommendations to the central meeting.

Prof. Harcourt.—I presume the object of this plan is to allow a greater number of the members to have a say in the conducting of its affairs. If this could be accomplished, I think it would be an advantage to the work as a whole.

The Chairman.—All that is required is simply an expression of opinion to the effect that there are no serious objections to this plan. The Constitution of the Association, as it now stands, contemplates sooner or later the establishing of branch Associations. In the meantime, it is sufficient for the chair to declare that this Association approves of the calling together of conferences of members of the Association whenever and wherever the executive may decide.

The second recommendation of the Board refers to some amendments that it is proposed to incorporate in the constitution, to modify sections 30 and 32 in a way to enable the Association to give recognition to the work of certain individuals who may take as their foundation stock an individual plant, secured either through selection alone or as the result of plant breeding following by selection. If we take an individual plant of wheat, oats or barley, of outstanding merit and select and propagate from that plant it would take at least four years before we would have sufficient seed to sow a quarter acre plot. According to the Constitution, each member must operate a plot of at least a quarter acre. The proposed amendments would make an exception in the case of those members who might choose to secure their foundation stock by selecting individual plants. The Board has suggested that this particular matter be left over and brought up again under unfinished business when we may have Dr. Robertson and Prof. Zavitz with us. Perhaps it would be well in the meantime, however, to present these amendments to the meeting in order that they may be more fully considered before being brought up again.

The SECRETARY.—The sections concerned are sections 30 and 32. Section 30 as it now stands, reads as follows:—'Each member must be a producer of improved seed, and must each year operate a hand-selected seed plot, consisting of not less than one-quarter acre of land, except in the case of potatoes. It is suggested that the following clause be added to this section: 'The provisions of this section shall not apply to members who may select individual plants of merit, for use as their foundation stock. The progeny of an individual plant may, at the discretion of the Executive Council, be accepted in the records of this Association as hand-selected seed in each successive generation until the quantity has increased sufficient to plant a hand-selected seed plot of one-quarter acre.'

Section 32 as it now stands reads as follows: 'It is permissible to select heads in sufficient quantity to sow a hand-selected seed plot or plots of a total area not greater than four times the size of the plot from which the heads were selected.' The clause which it is proposed to add reads as follows: 'The provisions of this section—at the discretion of the Executive Council—shall not apply to the selection of seed produced by an individual plant used as foundation stock, or to the progeny of such seed in successive generations, until the quantity of hand-selected seed has increased sufficient to plant a hand-selected seed plot of one-quarter acre.'

Senator PERLEY.—What do you consider as a plant?

The CHAIRMAN.—The product from one grain would be considered a plant.

Before deferring this matter of amending the Constitution, I would ask Prof. Klinck to explain to the Association how these amendments would serve the purposes of men like himself, Prof. Zavitz, Dr. Charles Saunders and others who are experts in plant breeding. In originating new varieties, they of course have to commence with the individual plant. It would be unreasonable to expect that they would adhere to the rigid system of selection now required by clause 32 in their endeavour to increase seed from the individual plant.

Prof. KLINCK.—In the system referred to by the Chairman, the individual plant is made the basis of selection. The object is to discover the most productive plant. When individual plants have been discovered which, judged by physical appearances give evidence of possessing the qualities sought for, they are isolated and tested as to their ability to transmit their qualities to their progeny. In order to secure these exceptional plants thousands of grains are planted four inches apart each way under the most uniform conditions. At harvest time all plants which do not closely approximate the standard of perfection established are discarded in the field. Out of eight or ten thousand plants, rarely more than one hundred are deemed worthy of being taken to the plant store-room. In the winter these plants are threshed separately, and those that do not come up to the standard in number and quality of grains are discarded. Of the hundred plants so examined in the laboratory all but ten or twelve are rejected. Next spring the progeny of each of these mother plants is sown in a small plot by itself. Those mother plants which demonstrate their superiority are retained and multiplied; the poor ones are discarded. As soon as the seed from the mother plant which has proven itself to possess the highest projected efficiency has increased sufficiently to plant a multiplying plot of several acres a distribution of the improved strain is made.

The CHAIRMAN.—The system of plant improvement as outlined by Prof. Klinck is one which can best be followed by specialists engaged in experimental work. There are at the present time exceedingly few farmers who go to the length that Prof. Klinck has described in improving plants or in bringing out new varieties and strains.

That system requires exceedingly careful work, a great deal of attention and more than ordinary ability to differentiate between individual plants, in order to select something better than we now have. According to our present Constitution, these new strains and varieties which are discovered or produced by experts receive no recognition by this Association when they come into the hands of its members. It is understood then that these proposed amendments would give recognition to the seed produced under the direction of Prof. Klinck, Prof. Zavitz, Dr. Chas. Saunders or any other expert who sees fit to take up that sort of work. There are a few individual members, graduates of Agricultural Colleges and others who are now taking up that work and who do it very well indeed.

The next item on the program concerns the grant which the Association receives annually from our Department of Agriculture. The opinion of the Board of Directors is that the grant of $3,000 which was made last year was sufficiently liberal to enable the Association to carry on its work up to the present time. There are still two months to run yet, however, and I am advised that practically all the funds have been used.

Senator PERLEY.—As a result of the experiments you have made, have you increased the quantity of wheat per acre in any province of Canada? What is the result of these experiments and tests? In the Northwest Territories we do not have half as many cars of wheat grade No. 1 as we used to have. The standard quality of our wheat has not improved as we hoped it would do if we had proper seed.

Mr. INNES.—Any active member of the Association could show Mr. Perley that the work he is doing is giving good results. When we commenced work in the Macdonald Seed Grain Competition with the variety of oats best suited to our land these weighed only 38 pounds to the bushel. After a number of years of selection we have them weighing 42 pounds to the bushel before being cleaned. Every year there was an increase in the yield and an improvement in the quality.

Moved by Mr. Wheaton, seconded by Mr. Donald Innes, that application be made to the Minister for a grant to the Association on the same basis as that made last year and also that application be made to have the annual report printed.—Carried.

The CHAIRMAN.—There is a recommendation in respect to encouraging further experimentation in the production of field root and garden seeds in Canada.

Moved by Mr. Wheaton, seconded by Mr. Raynor, that the recommendation of the Board be approved.—Carried.

The CHAIRMAN.—The Board wishes to recommend further that an expression of appreciation be forwarded to the railway companies which provided special transportation rates to the Secretary of the Association when travelling and looking after the official duties of the Association. I presume this may be left with the Committee on Resolutions.

Moved and seconded, that Prof. Klinck and Mr. Wheaton, be a committee on resolutions.—Carried.

Moved by Mr. Raynor, seconded by Mr. Wheaton, that Prof. Zavitz, Mr. Gigault and Mr. Davidson, be a committee on nominations.—Carried.

The CHAIRMAN.—The next order of business is the report of the Secretary-Treasurer.

REPORT OF THE SECRETARY.

(L. H. Newman, B.S.A.)

Mr. President and Gentlemen,—I have the honour to submit herewith my fourth report as Secretary-Treasurer of the Canadian Seed Growers' Association The report of the last annual meeting has been printed to the extent of 20,000 English copies and 5,000 French. Of these, 19,000 English copies have been distributed throughout Canada while 4,500 copies of the French edition are now ready for distribution. Copies have also been sent in exchange to all Experiment Stations in the United States, Great Britain and other English and French speaking countries in Europe.

During the past year, steady and substantial progress has been made by the Association in all that goes to constitute the essentials of successful endeavour. The membership has increased, the interest has grown, the results of the work have been substantial and significant and the public in general has gained a clearer conception of the true function of our organization.

The main factors that have been efficient in bringing about this happy condition will be referred to later.

Advancement has also been made in our study of how best to bridge over the gap which exists between scientific endeavour and traditional mediocrity. That our work and influence as an Association will be effective only in so far as we are able to sustain intimate relations with the man on the land has been abundantly proven. Acting on this assumption, we have seized every opportunity to get in direct touch with as many as possible of our actual growers, with encouraging results.

As we grow in age so do we grow in knowledge and many of the problems with which we were confronted in the earlier years of our existence are gradually but surely working out their own solution. The primary object of the Association being an educational one it has been our aim to maintain a lively interest in the whole question of plant improvement by keeping our growers well informed, believing that an educated and well disciplined mind is the first essential for any real and lasting progress. While the operating of a special seed plot might be commended purely on account of the influence of such work upon the individual, yet experience goes to show that the commercial spirit has always preceded any widespread advancement along educational and ethical lines. We have therefore endeavoured to devote considerable time to the commercial end of the work, believing this to be the only logical medium through which to establish a sound basis for permanent growth along other lines.

The number who have reported upon the results of their work for the season of 1908 is 236, of which number satisfactory hand-selections of seed have been made by 100. Of this number 71 have already been admitted into the Association in full standing, so that there remain 29 who are now entitled to formal admission and whose election we recommend. The names of these persons are as follows:—

Mr. J. H. Abel, Lloydminster, Alta.
Mrs. E. Bedford, Morden, Man.
Mr. M. Cloutier, St. Pierre, Que.
Mr. R. H. Carter, Fort Qu'Appelle, Sask.
Mr. R. Canning, Hagerman, Ont.
G. W. Coatsworth & Son, Kingsville, Ont.
Mr. J. H. Coatsworth, Ruthven, Ont.
Mr. W. R. F. Collis, Shoal Lake, Man.
Mr. Manning Chute, Berwick, N.S.
Mr. T. W. Dunbabin, Craik, Sask.
Mr. A. F. Henderson, Morden, Man.
Mr. David W. Hyde, Shakespeare, Ont.
Mr. Alf. Hutchinson, Mount Forest, Ont.
Mr. S. W. Hampton, Graytown, Sask.

Mr. J. T. Hutchinson, Hayfield, Man.
Mr. Jno. Hunter, Wyoming, Ont.
Mr. Chas. Hastings, Murray Road, N.B.
Mr. W. Eakin, Eakindale, Sask.
Mr. Abr. Funk, Tiefengrund, Sask.
Mr. A. Gwillim, Churchbridge, Sask.
M. R. D. McKay, Balmoral Mills, N.S.
Mr. A. Maccoll, Aldboro', Ont.
Mr. W. T. Macoun, Exp. Farm, Ottawa, Ont.
Mr. Wm. Lewis, Dunsford, Ont.
Mr. L. Livingston, Minesing, Ont.
Mr. Geo. L. Smith, Saskatoon, Sask.
Mr. Ed. Smith, Ridgetown, Ont.
Mr. A. H. Woodbridge, Kingsville, Ont.
Mr. W. G. Schurman, Ross' Corner, P.E.I.

Those who have formally signified a desire to take up special work under the direction and with the assistance of the Association, but who have not yet complied with the regulations sufficiently to entitle them to the rights of membership are classified as follows:

APPLICANTS.

—	Mar. Dist.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alta. and B. C.	Total.
Seed wheat growers	23	7	28	20	56	27	161
Seed oats growers	28	15	50	14	18	25	150
Seed barley growers	9	3	30	9	5	5	61
Growers of seed corn	3	1	68	......	.....	......	72
Growers of seed potatoes	18	2	29	1	7	5	62
Applicants not yet specifying crop	7	12	11	4	2	3	39
Growers of seed of miscellaneous crops, such as beans, pease, &c	5	2	8	2	1	1	19
Total	93	42	224	50	89	66	564

Since a great many growers are operating with more than one kind of crop, the above arrangement indicates the relative interest taken in the various crops, but does not represent the actual number of special growers involved. The following summary affords a better idea of the exact standing of the Association in so far as actual numbers are concerned:—

SUMMARY.

Total number on application list before revision		495	
Number of applicants removed from list of active operators	97		
Number of applicants removed to membership list	29		
	—	126	
Actual number of applicants			369
Actual number of members reporting satisfactorily		71	
Actual number of members failing to make satisfactory selections	49		
Number of old members dropping the work	10		
	—	39	
Actual number of new members reporting satisfactorily		29	
Total number of members in full standing			139
Total number now affilated with the Association			508

The number of applications received during the past year is 79. Many of these have reported satisfactorily while others have explained by letter that they are doing the best they can to make a good beginning in the work.

Those applicants who fail to make a beginning in the work of seed selection within three years from the date of the receipt of their application, are placed on the list of 'prospective' members in order that they may receive our general publications, but not the blank forms and special directions.

INSPECTION OF SEED PLOTS.

Owing to the numerical increase in the membership of the Association, provision was made early in the year to visit only those who were known to be operating or who were just beginning the work and were specially anxious to receive more specific information as to how to proceed. In order that definite information might be had, the following inquiry card was issued to very grower on June 10, 1908:—

CANADIAN SEED GROWERS' ASSOCIATION.

CANADIAN BUILDING, OTTAWA,
JUNE 10, 1908.

With a view to preparing a list of those who are either operating a hand-selected seed plot, or plots, according to the system adopted by the Canadian Seed Growers' Association, or who are just starting in the work, and who may desire to discuss certain parts of it with the inspector, the following information is asked for at this time:

1. Are you operating a seed plot or plots this summer? . . . .
   If so, please give names of crops . . . .
2. If you are not operating a special hand-selected seed plot as above, to what extent are you operating? . . . .
3. Have you any special difficulties in connection with the work of crop raising that you would like to discuss with the inspector should he be in your locality this summer? . . . .

Name . . . . P. O. . . . . No. Lot or Section
. . . . Township . . . . Concession or Range . . . .
County . . . . Province . . . .

Kindly fill in the above blanks and return card by return mail,

Sincerely yours,

L. H. NEWMAN,
Sec. C.S.G.A.

One month was allowed the grower to return his card, at the end of which time the inspectors' lists were prepared complete for each district and handed the Seed Commissioner who had agreed to authorize the representatives of his Branch in the various districts to inspect the seed plots of those of our members who were known to be operating.

The work of inspection was executed by these officers or by men specially engaged by them for the purpose, in the following districts or provinces, viz.: The *Maritime District*, the *Quebec District*, the *Ontario District*, the *District of Alberta and British Columbia* and in a few places in *Saskatchewan*. In Manitoba and in the greater part of Saskatchewan, your secretary inspected the plots personally and examined into the conditions which prevail in the various local centres in these provinces. A report of the work in these Districts is given elsewhere in this report.

In our last report, reference was made to an improvement in the system of scoring the seed plots which was being introduced, while a copy of the score card devised for this purpose was also submitted. In order that the system inaugurated might be still more effective, the plan of leaving a carbon copy of the score card with the grower has been followed in most cases during the past summer. The chief virtue in this plan lies in the knowledge the grower receives, first of the various points which go to make up a good crop and secondly, of the degree to which his own crop has approached the ideal condition.

The importance of personally inspecting the work performed by those known to be operating becomes more apparent with each recurring season, since the success of the work as a whole will depend upon the comparative few who will carry out the regulations carefully and do the work thoroughly rather than upon the larger number of growers who may continue to operate in a more or less perfunctory way. By helping those who are prepared to help themselves rather than wasting time trying to enthuse those more or less lethargic individuals the work should advance more effectively and surely.

The following is a summary of the work of inspection for the season of 1908:—

—	Mar. Dist.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alta. and B. C.	All Provinces.
(1.) Number of growers on inspectors' lists prior to beginning work of inspection (July 10)...................	87	66	207	46	78	52	536
(2.) Number answering inquiry cards and stating they were operating, or that they wished to be visited...	26	16	50	19	21	7	139
(3.) Total number visited by inspectors...................	46	18	78	29	14	14	199

While inspecting the plots of the various growers, many opportunities were taken advantage of to call on others in the locality who were either on our list of applicants or who had been recently recommended.

CONDITIONS OF THE WORK OF THE ASSOCIATION IN THE DIFFERENT DISTRICTS.

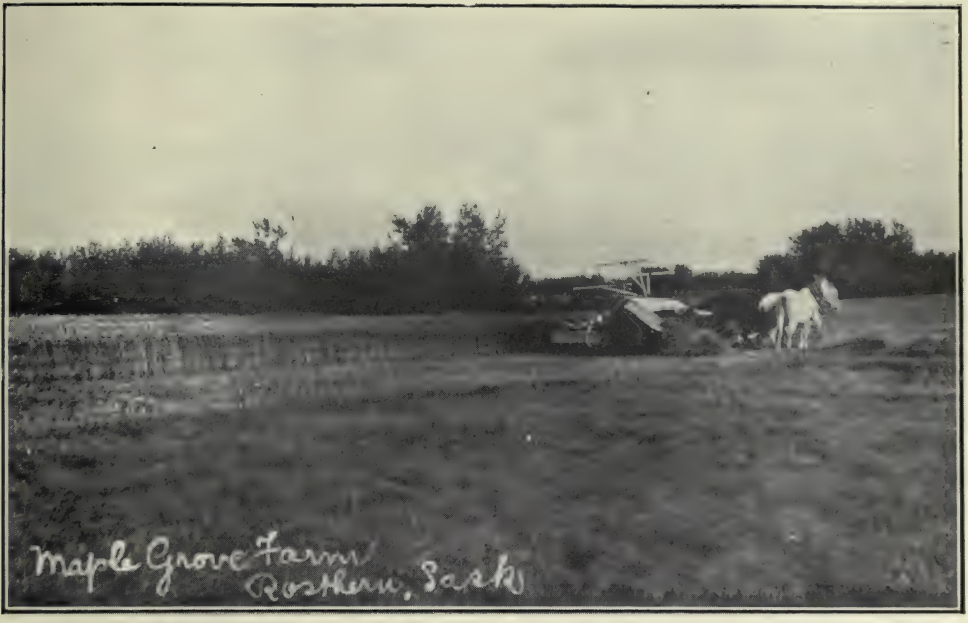
In Alberta and British Columbia.

The work of the Association in Alberta has taken a decided step in advance during the past year, not only in point of numbers who have shown an interest in the work but in the number who have actually carried out the regulations of the Association in respect to the selecting of seed. The growth of the work in British Columbia has also been substantial. In some of the valleys, some excellent work is being done with potatoes while there seems to be a growing interest in other lines as well.

While the number actively engaged in special work in seed growing in these two provinces is not large, yet it has been thought advisable to establish an annual exhibition at some convenient centre where members might have an opportunity of showing the products of their work. This exhibition is being held to-day (Feb. 4) at Calgary, a report of which will be forwarded by Mr. McKillican of the Seed Branch for publication in this report.

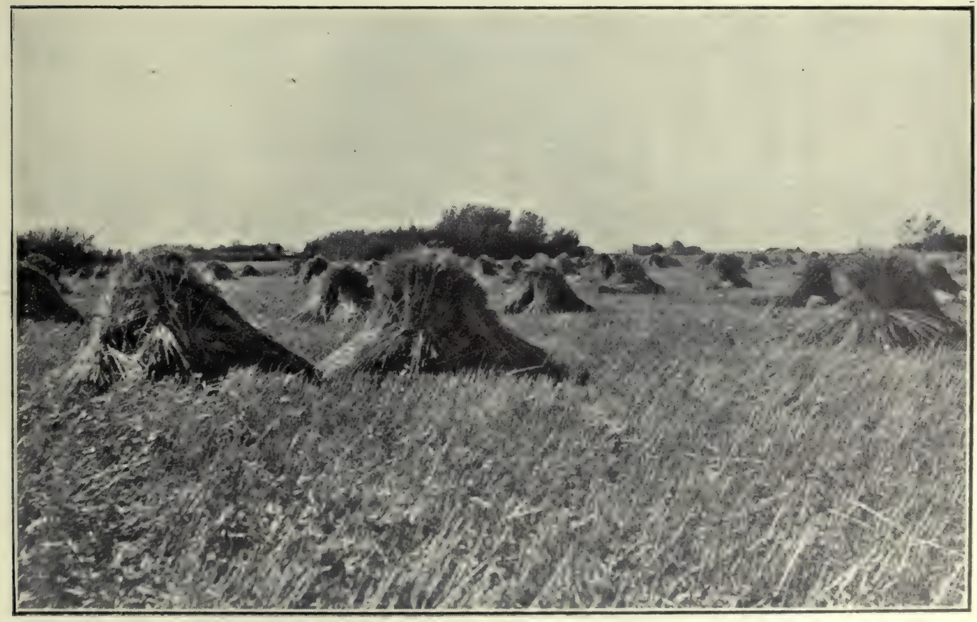
The crops receiving the greatest attention in Alberta are given in the order in which they are being considered as follows: White Oats, Spring Wheat, Fall Wheat and Barley. In oats, the Banner variety still claims first place in popularity. In Spring Wheat, the Red Fife variety still has a strong following although there is a gradual tendency to take up earlier sorts. In Fall Wheats, the Turkey Red is grown almost exclusively south of the main line of the Canadian Pacific Railway, but as you go north there is a growing tendency to favour Dawson's Golden Chaff, it being claimed that this variety does better on the more scrubby land of the north, and also stands up better in those districts where the precipitation is greater.

The climatic conditions with which our Alberta members have had to deal during the past season may be summarized as follows: The Spring opened quite early and



(Photo by Seager Wheeler.)

Fig. I.—Harvesting Seed plot of Preston wheat near Rosthern, Sask., after selecting a few pounds of the best heads to sow next year's plot.



(Photo by Seager Wheeler.)

Fig. II.—Field of Preston wheat adjoining seed plot shown above in Fig. I.

seeding was completed in record time. In June the precipitation was heavy and all vegetation grew rapidly. July and August were cool and ripening was therefore considerably delayed. In some sections in the south and southeast, the crops suffered from drought while in the northern districts early fall frosts did considerable damage.

In Saskatchewan.

In Saskatchewan the work of the Association is as yet in a comparatively primitive state. Owing to the newness of the country and to the corresponding lateness of the soil which brings the date at which the leading crops usually reach maturity dangerously near the period when frosts are liable to occur, the percentage of growers who are still undergoing the transition period from the pioneer settler to the well established farmer is greater than in the older districts. As a consequence, the number who have been able to engage in special work and make a good showing in the Association is comparatively small. It is gratifying to note, however, that the number of active workers is increasing steadily as is also the general interest in the work.

The crops which are receiving the greatest attention by the Association in this province are *Wheat, Oats* and *Barley* in the order in which they are named. In wheats the Fifes still retain their popularity although there is a strong and growing tendency in the later districts to adopt earlier maturing sorts. As a result, we find such varieties as Preston and Stanley gaining in popularity with the growers, although these are not so popular with the milling fraternity. In oats, the Banner variety still holds first place in popularity although the Abundance is receiving a good deal of favour just at present. In barley, the Mandscheuri and Mensury varieties have the preference and seem to be well adapted to western conditions.

The climatic conditions which prevailed during the past season are given quite fully in the reports of the Provincial Department at Regina and need not be repeated in detail in this report. It may be well, however, to summarize the general conditions which prevailed during the growing season since such have a very important bearing upon the success of our work.

Seeding was early and the seed went into the ground under unusually promising conditions. Up to the end of June the outlook promised a bumper crop. July, however, was very dry in most districts, the injurious effects of which were greatly intensified by several days of hot dry winds. As a result of these conditions, the yield was reduced very materially. Hail storms also occurred in various parts of the province while on August 13, one of those much feared menaces of the grain grower—early frosts—visited many districts and did a good deal of damage to the late maturing grains. Reports of the attacks of Rust, Green Bug, Hessian Fly, Wire worm and Cut worm have been received but none of these have caused serious trouble to our special growers.

In the northwestern districts along the main line of the Canadian Northern Railway from Battleford west, the heavy rains which prevailed during harvest did considerable damage to the stooked grain, in some instances causing sprouting. On the higher ridges along this line, however, some excellent crops were realized, the frost referred to above being restricted to the lower areas.

Another factor with which not a few growers have had to contend is the ravages of gophers. In some cases these pests had practically ruined the entire crop or had thinned the stand to a very serious extent.

In Manitoba.

The work of the Association in the province of Manitoba is progressing most favourably. Already the quality of the work that is being done is on the whole of a higher order than that in any of the other five districts, while the quantity of seed produced for the trade is likewise greater. The increasing interest which is being taken by the ordinary grower in the quality of the seed he is using reflects something of the influence which is being exerted on the farming community generally by the existence of special men here and there throughout the country who are devoting special attention to the question of crop improvement. As time passes the membership of the Association is gradually being swollen from the ranks of the ordinary grower until we are gradually coming to have banded together a body of men the influence of whose work it would be indeed difficult to forecast.

As a means of enhancing the value of this work in the province and of providing the means whereby it may receive greater publicity, arrangements have been made to hold a meeting of the members of the Association resident in the province at Brandon during Winter Fair week in March. Special reference will be made to this later.

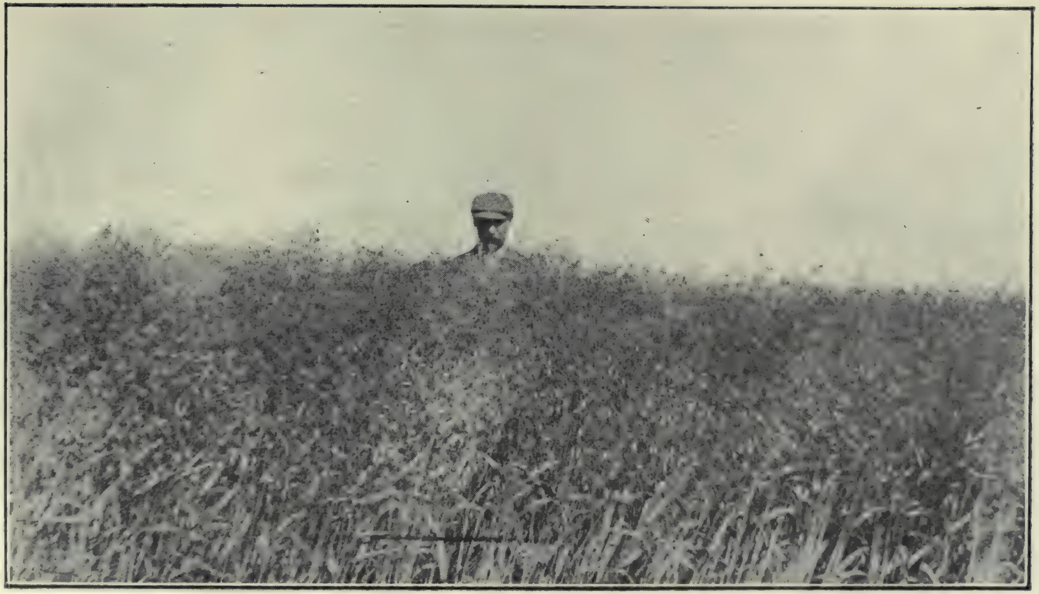
The varieties receiving the greatest attention from our various growers are as follows: In Wheats, the Fifes easily retain first place, particularly in the southern districts. North of the main line of the Canadian Pacific Railway, however, there seems to be a growing disposition to grow early maturing varieties. Such varieties as Preston, Huron and Stanley seem to be gaining in popularity while the work of the Experimental Stations in trying to produce still better early maturing sorts is being watched with increasing interest. The growing of Fall Wheat in the northern districts is also receiving considerable encouragement, owing to the fact that this crop usually matures before frost. This year the crop was cut two weeks before the first frost appeared and yielded greater than did the spring varieties. The Turkey Red and Dawson Golden Chaff are the varieties generally grown, although the latter is gaining in popularity owing chiefly to its stiffer straw and heavier yield. Very little winter killing was reported and altogether the outlook for the success of this crop is bright. Some of the best growers have affiliated themselves with our Association and are preparing to test a number of different varieties prior to making a choice of some one kind upon which to do special work.

In Oats, the Banner variety still holds the lead although the Abundance or Sweedish Select, recently introduced by the Gartons has met with a good deal of favour during the past season. The Barley grown by our members is practically all of the Mandscheuri or Mensury varieties.

While the conditions which prevailed in the province during the growing season were as a whole quite favourable, yet they were exceedingly variable. In the southern sections, the Spring was favourable, but in most cases the summer was very dry there being no rain of any consequence after June 15. This resulted in an early harvest with shrunken yields and often a somewhat shrunken berry. Hail did some damage in restricted areas while a frost of 2 or 3 degrees on the morning of August 13 and again on the 22nd did considerable damage to the uncut grain. In the Dauphin district, the past season has been extreme. The spring was very wet and seeding was therefore delayed until late, while the summer has been very dry. Growers in this district have therefore had difficulties to face which have not been met with in the majority of places.

In the Swan River district, the season was dry while early frosts did considerable damage to the spring sown crops. In the northern districts, as a whole, the rainfall was considerably greater and the yields correspondingly heavier. Wheat grown on scrub land and on summer fallow in those districts where the rainfall was slight gave larger returns than did that grown on breaking or stubble land, since such soil is more retentive of moisture and is thus able to store up and retain a greater quantity of water from the spring rains and winter snows. Soil underlain with shale or gravel, such as that peculiar to certain sections along the Souris Branch of the Canadian Pacific Railway, suffers most from lack of rainfall and hence the crops in these sections were affected to a considerable extent.

In the older sections, the system of farming is gradually changing on account of the effects of continuous and injudicious cropping resulting in a depletion of soil fertility but more especially in the introduction of noxious weeds of all sorts. In some of these districts, the grain crops are also badly mixed with foreign varieties resulting in an uneven grade. In many cases the average farmer has more land than he can properly work so that a readjustment in the 'modus operandi' seems imperative. In districts which are infected with wild oats, many farmers are growing barley



(Photo by L. H. Newman.)

Fig. III.--A good plot of Abundance oats grown near Shoal Lake, Manitoba.

as a means of overcoming this pest. The plan usually followed is to plough in the fall, cultivate early in the spring to start the growth and then plough, not too deeply, later and sow with barley.

Taking the province as a whole, the most noiceable peculiarities in connection with the crop of the past season were the unevenness with which the crop matured and the conspicuous freedom from smut and rust. The seed plots of members of our Association however, matured much more evenly than did the ordinary fields throughout the province and as a result a more even grade and a supply of more productive seed is to be expected from these sources.

In Ontario.

In Ontario, the work of the Association is gradually extending while the increased interest that is being taken in the matter of good seed in general is encouraging. The various agencies which have been at work to bring about this condition will be referred to later. The crops receiving the greatest attention are corn, oats, barley, wheat and potatoes, in the order in which they are named.

The varieties of corn which are receiving the greatest attention at present are White Cap Yellow Dent, Reid's Yellow Dent and Leaming in the Dents, while in the Flints the Compton's Early, Salzer's North Dakota, King Phillip and Longfellow hold first place. Considerable work is also being done with sweet corns, the Stowell's Evergreen being the variety most largely worked with.

In oats, we have a somewhat large assortment of varieties. The Banner still holds first place although such varieties as Siberian, Ligowo, Newmarket and Daubeney are coming in for a liberal share of attention. In Barley, Mandscheuri, Mensury, Oderbrucker and No. 21 are the leading varieties.

In wheats, the fall varieties are receiving greater attention than are the spring. Of these, the Dawson's Golden Chaff and Abundance are most in evidence. In the Spring varieties, Red Fife is the only variety that is being worked with at present, and this only in a very small way. The acreage under spring wheat, taking the province as a whole, is, according to statistics, decreasing from year to year, showing that this crop does not occupy a high place commercially. Emmer, a type of spring wheat belonging to another class is gradually gaining ground in the province as a feed wheat and considerable interest is being taken in the seed that is being used.

In potatoes, there is quite a variety of different sorts although those conforming to the Carman type are most popular on account of the smoothness and quality peculiar to this variety.

The climatic conditions which prevailed throughout the province during the past season together with the outcome of the crops may be summarized as follows:

The spring was rather cold and wet delaying growth considerably. Warm rains with bright weather followed in May so that vegetation grew rapidly. During fall wheat harvest, the weather was characterized as warm and wet so that considerable sprouting occurred while the grain was in the stook. The larger part of the growing season, however, was very dry and as a result the crops did not yield as they had promised earlier in the season. The barley crop was seriously affected by the hot dry weather which prevailed about ripening time while spring wheat, though later in maturing, also suffered. The oat crop, though light in some of the eastern and northern counties, was as a whole fairly satisfactory. In some districts rust and grasshoppers did considerable damage while in others improper cultural methods were followed by correspondingly poor returns. An instance of this was to be found in the Dryden district, New Ontario, where the soil is largely a white clay which bakes readily. In this district, many farmers ploughed their land in the spring before it was properly dried and as a consequence it baked to such an extent that growth was very seriously retarded. The wet spring followed by a spell of hot dry weather helped to make the soil still harder until, in some cases, growth was almost impossible. Where ploughing had been done in the fall and the land thoroughly worked in the spring, after it had dried sufficiently, the physical condition was such as to promote a rapid and satisfactory growth.

In the Quebec District.

In the province of Quebec, the work of the Association is not advancing so rapidly as it might although, as was explained in the report presented last year, it is difficult to judge from the reports sent in, the real progress that is being made, since our French members are better seed growers than they are reporters. The one great drawback to the work in this province has been our inability to hold an annual meeting of our Quebec members at some central point in order that the interest might be maintained and the work placed on a more business-like footing. This year, your Executive proposes to inaugurate a scheme whereby an annual meeting of the members of the Association resident in Quebec may be held in the French language at some convenient centre during the coming spring if possible. In this way, it is hoped that an impetus may be given the work and that a greater number may take hold of it with a view to producing a substantial supply of high-class seed for the Quebec trade.

Heretofore, many new beginners have failed to gain a proper grasp of the real meaning of the work and of the correct course to pursue. Some have selected their seed from the stook instead of from the standing plants, while others again have not even taken the pains to go this far toward ensuring a better source of supply. The results of the past year's work would indicate that the regulations have been carried out more thoroughly and seriously than in former years, although there is still considerable room for improvement.

The most important crops with which special work is being done are oats, spring wheat, barley and potatoes. In oats, the Banner variety is most in evidence although the old so-called 'Canadian' oat is still popular in some sections. In wheats, the Red Fife and White Fife are the principal varieties grown although this crop does not occupy a large place in Quebec Agriculture.

The potato crop in Quebec is an important one, exceeding in value that of the three maritime provinces combined. Quebec potatoes, however, are not at present so popular commercially as are those of the maritime district owing to the lack of uniformity of the product. As in Ontario, the production per capita is comparatively small and each grower has his own variety. Under these conditions it is very difficult to secure an even lot in any considerable quantity and as a result the larger potato growing centres of the maritime district are resorted to. During the past year considerable interest has been taken in the question of potato improvement and in a short time we hope to have an important line of work well established in this province.

The climatic conditions which prevailed throughout the province as a whole have not been favourable, the weather being generally described as extreme. The spring was very wet while the summer which followed was equally dry. The result was that much of the grain ripened prematurely. Hail and early frosts also did some damage. In some districts grasshoppers did considerable injury to the growing crop. Altogether our Quebec men have had considerable to face in the way of difficulties over which they had no control and they can well be excused if they have not been able to supply such glowing reports as are received from some of the other districts.

In the Maritime District.

The work of the Association throughout the maritime district is in a most prosperous condition. Nowhere in Canada have we a more intelligent and progressive body of men and nowhere is the work better organized. This happy condition is largely the outcome of those circumstances which combined to make possible the holding of an annual meeting of the members of the Association resident in the district, in connection with the largely attended winter fair at Amherst.

The general interest in the use of good seed has also increased greatly. One evidence of the growing interest is found in the disposition of certain Agricultural Societies to secure seed grain through the Association. This tendency would also indicate a growing confidence in the Association as an organization to which the grower may look for reliable information and direction.

The crops with which special work is being done most largely are given in the order of their importance as follows: Oats, wheat, barley and potatoes. In oats, we have several varieties represented although the Banner variety still holds first place. Black varieties are also grown here to a greater extent than in any of the other districts. In wheat, the white Russian variety holds first place in Prince Edward Island, while Red and White Fife are grown more largely in New Brunswick and Nova Scotia. In Prince Edward Island the acreage under wheat has decreased appreciably owing to the ravages of the Joint-worm. Some of our members are, therefore, dropping wheat and devoting special attention to oats or some other crop or crops.

In barley, the Mandscheuri and Mensury varieties are the only varieties receiving special consideration by our members, while in potatoes, a crop which is usually so productive in varieties, we have a fairly wide assortment. In Nova Scotia and New Brunswick the Green Mountain variety claims first place while in Prince Edward Island the Early Harvest is gaining ground rapidly chiefly on account of its ability to resist disease to a greater extent.

The climatic conditions with which our growers have had to cope in this most eastern district of the Dominion may be summarized as follows: In the majority of districts throughout the provinces, the spring was wet and cold followed by a very dry summer although the fall was favourable for the harvesting of the later maturing crops such as roots. In certain sections, high winds in early August tended to lodge some of the grain crops although the very dry weather of harvest prevented serious damage from this source and facilitated the securing of a very fair sample. Taking the district as a whole, conditions might be classed as average to poor although the progress made by the Association has been rather above the average of former years.

SUMMARY OF THE CONDITIONS OF THE WORK IN THE SIX DIFFERENT DISTRICTS.

Taking Canada as a whole, the work of the Association is in a healthy and prosperous condition. Excellent work is being done in every province and all crops of any considerable importance are being worked with. Many growers who began work with one kind of crop have extended their attention to several additional classes while greater interest is being taken in the question of good seed by the ordinary grower throughout the country generally.

Among the various factors at work in stirring up a greater interest in this important branch of Agricultural endeavour, special reference should be made to the vigorous campaign that is being waged throughout many parts of Canada by the Seed Branch of the Dominion Department of Agriculture through the medium of Seed Fairs, Field Competitions and special meetings. Working hand in hand, the Department and the Association have been able to assist each other very materially. The Department, through its educational propaganda, is gradually filling the ranks of the Association with growers who wish to become actively engaged in the business of seed growing and who desire special assistance and direction in this work. The association on the other hand assists the Department in its educational campaign through the influence of the work of those growers who have achieved success under its direction. Just here it may be opportune to interpolate the observation that a farmer has more confidence in the advice of the man who has met with success than he has in that from any other known source.

The great agricultural press of the country together with many of our daily and weekly papers has devoted much space and careful attention to the matter of good seed and crop improvement. We also find a great many of the best minds of the times in scientific circles carefully and patiently engaged in elucidating the biological problems upon which depends to no small extent our success or failure as an organization of plant improvers.

Following in the wake of this wave of awakened interest which is sweeping over the country are to be found many who have caught the spirit of the New Agriculture and who are recasting their habits of thought either completely or in part. All these things are pregnant with meaning and bespeak a great future for those who look to the soil as a source not only of livelihood but of pleasure and contentment.

The weather conditions of the past season as a whole have not been encouraging and in many districts disappointment might be looked for. Happily, however, our Canadian farmer does not readily succumb to disappointment and failure, but possesses that buoyant optimism which presages naught but success. The following is a copy of a letter recently received from one of our growers though this gentleman has not been favoured with especially encouraging conditions during the past year: 'The work grows more interesting each year and is of great educational value to me, for in the constant routine of farm management there is a strong tendency for one to think only of the present day and as a result drop into a rut. Such work as is required in seed improvement keeps one in an alert, progressive state of mind.'

WORK BEING DONE WITH THE DIFFERENT FARM CROPS.

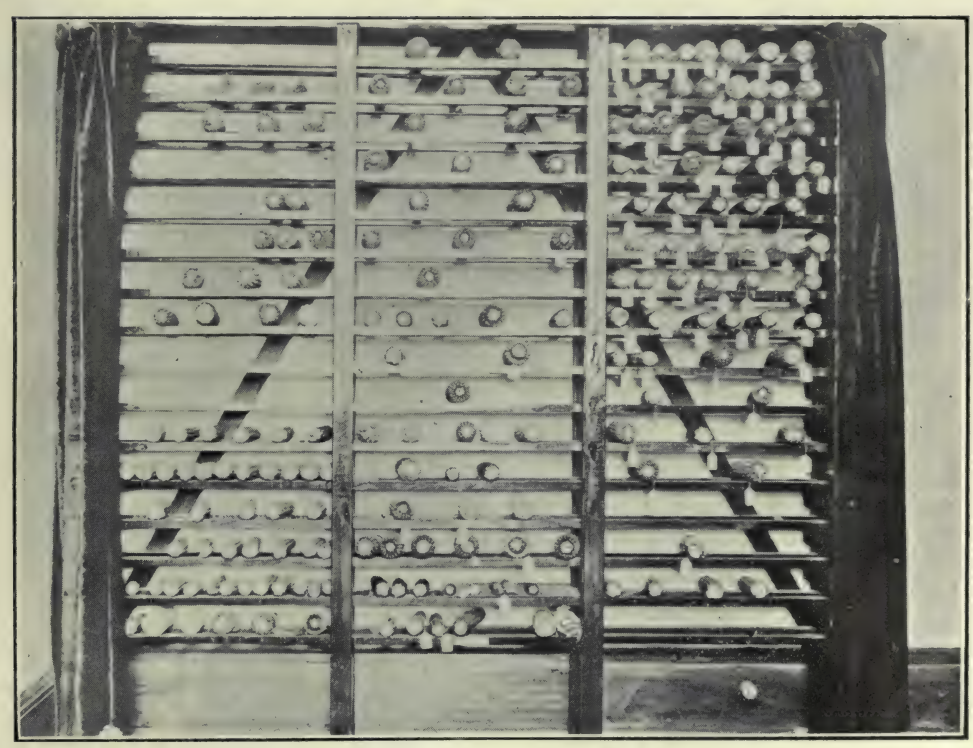
THE SMALLER CEREALS (OATS, WHEAT, BARLEY.)

In the report of the Secretary for the year ending June 30, 1907, and again in the report of the Fourth Annual Meeting of the Association, the main claims of the system of selection adopted by our Association have been explained and elaborated upon quite fully. With these publications for reference, it will not be necessary in this report to more than append a few remarks showing to what extent these claims are being substantiated and to what extent results are forthcoming. Careful personal study of many fields and plots together with an examination of reports received from the inspectors and from the growers themselves during the past season clearly indicates that the problem of maintaining the purity of the strain continues to be a serious one. In addition to this there is still recognized the omnipresent tendency among our cultivated crops to depreciate in productive capacity in the absence of any system which effectively and regularly precludes the possibility of utilizing the product of weaklings for seed purposes.

Apart therefore, from any possible improvement which may result from a careful methodical selection of seed from the best plants year after year, the system continues to prove of incalculable value in providing the means whereby the average farmer may secure pure seed year after year. Another very commendable feature of the work is the effect it has in controlling the insatiable desire for something new among varieties. While we all recognize the great difference between varieties and the importance of making a careful choice, yet we are equally cognizant of the danger which exists of being over zealous in this particular. Our growers now find that once they have secured a variety which measures up to their idea of what a good variety should be able to do under their conditions, they are able to bring it up to a point quite beyond the probable reach of any new importation.

As to the methods by which it is claimed best results may be realized in improving plants, authorities differ. An excellent exposition of the ideas held by the different authorities of the present day, together with a brief historical sketch of the work of the most noted of our earlier breeders is given in the American Breeders' Association, Report, Vol. IV in the 'Report of the Committee on Breeding Cereals.' Prof. L. S. Klinck, of Macdonald College, Que., as Chairman of this Committee deserves special praise for the collation of so much valuable data on this subject. We would commend this report to the careful consideration of our Canadian growers as a medium through which they may become acquainted with the special work in plant improvement that is being done by men of special training throughout the civilized world. For the average farmer, the system adopted by our Association is still looked upon as being the most practicable and workable, the more complicated systems being left for the special use of Experiment Stations or for those individuals who are in a position to take up the work along the more complicated lines.

The most valuable grain crop in Canada being the wheat crop it is natural to expect that this crop should receive the greatest degree of attention. An examination of



(Photo by L. H. Newman.)

Fig. IV.—A good rack for storing high class seed corn.

the list of growers of the different crops will show this to be the case, although the oat crop is a very close second. In the West the wheat crop is looked upon as the great regulator of public prosperity and indeed this may be said to apply to the country as a whole. The high reputation which Canadian wheat holds in the markets of the world, together with the dangers with which it continues to be menaced, demands that we not only do all that we can to increase the output each year, but that we exercise the greatest of care in safeguarding the quality of this great cereal. The special work which this crop is receiving in the different provinces has already been referred to.

The oat crop, as has just been explained, stands practically on a level with the wheat crop in so far as the receiving of special consideration is concerned while present prospects seem to indicate that this crop will very soon occupy a much more prominent place among the crops with which special work is being done. This is the outcome of certain difficulties which are rather more pronounced in the case of oats than in that of wheat. We find there to be a greater difference in plumpness, uniformity of sample and general quality between any given number of samples of oats than is likely to be found between an equal number of wheat samples and as a result the opportunities for close discrimination and careful multiplication of selected types are greater. Then again the oat plant seems to be more variable and responsive to external influences than is the wheat plant thereby exposing with greater readiness, any deficiencies such as lack of vigour, which it may possess.

The demand for specially selected seed oats is also increasing not only from Canadian growers but from our southern neighbours across the border. This demand has not gone unnoticed as a considerable number of farmers who have been in the habit of selling oats for seed purposes in quantity have affiliated themselves with our Association with a view to being able to supply the desired high-class article in registered lots.

The barley crop is also receiving greater attention in Canada than it has since this Association first began operations. In the older parts of Manitoba it is being used as a means of combatting wild oats while in Alberta it is coming to the front with the development of the brewing industry. As a crop it fluctuates readily in quality and yield but responds with equal readiness to careful selection. The opportunities for good work with this crop in Canada are abundant.

WORK WITH CORN.

The special work that is being done with corn in Canada is confined almost exclusively to the province of Ontario, although nearly all the provinces are doing more or less special work with this crop. In the third annual report of the Association (page 11), the problems before the corn grower in both the northern and southern sections of Canada are clearly defined while reference is also made to the system of breeding which the Association has adopted. In the Report of the Secretary for the year ending June 30, 1907, pages 14-16, is given a more complete résumé of the standing of the corn crop, the description and distribution of leading varieties and some general conclusions regarding the best course to follow, while a note is added regarding the growing of corn in Western Canada.

The corn crop has been an exceedingly important one in Ontario for many years while more recently it is coming to fill an important place in Quebec, the maritime provinces and even in parts of the West. The extent to which it may be made to give profitable returns under the hand of the skillful breeder in regions hitherto thought to be hostile toward so tender a crop explains in part the reason for this extension of the work. As an Association we have in hand a most interesting and fertile field for useful work with this crop. Results achieved thus far have been encouraging, while the actual work of manipulating a corn breeding plot has proven most effective in demonstrating some of the fundamental peculiarities of plant life. The subject of corn breeding in Canada is such a comprehensive and important one that we have thought it advisable to give it special attention at this convention. Prof. Klinck will therefore deal with this in a special paper to be followed by a discussion led by Mr. J. O. Duke, representing the southern corn belt. With these various sources of information it will not be necessary to consider the question further in this report.

WORK WITH POTATOES.

During the past year the Association has devoted a good deal of attention to the problems associated with the improvement of the potato crop in Canada and has met with a substantial response from those who are actively interested in this important crop. The results which have been realized by some of our best growers and which have been published in previous reports have encouraged others to take up systematic work with this crop until we are gradually bringing together a goodly list of potato specialists.

In Ontario the potato industry does not occupy the place that it might. Though heading the list of all provinces in acreage and total yield, she does not produce a sufficient quantity for home consumption, but imports thousands of bushels annually from the maritime provinces. The statement has been made by large potato dealers in the large cities of Ontario that were potato growing in Ontario taken up on a larger scale in certain suitable centres and old, run out varieties replaced by newer varieties of a more desirable type, and were the number of varieties limited to one of two outstanding sorts, the potato trade might be kept in the province. While the present conditions are doubtless a good thing for the maritime farmer they are not in accord with the highest economic principles for Canada as a whole.

The Ontario authorities are beginning to realize these things and are giving some attention to this question. In the report of the Farmer's Institutes of Ontario for 1906 is given an excellent exposition of the status of the potato industry in the province. A copy of this publication should be in the hand of every potato grower. In the Report of the Secretary presented in June, 1907, may be found the system of potato improvement which the Association has adopted, while in our last report (page 21) is given some of the results which have followed upon the practical application of this system.

In the report of the proceedings of the present meeting, there will be included an excellent paper on the subject of potato growing by Mr. Harry R. Brown, Wallace Bay, N.S., one of our coming potato experts. One of the best of the recent American publications on this question is to be found in Bulletin No. 127 published by the University of Illinois and entitled: 'A study of the factors influencing the improvement of the Potato.' The author of this bulletin is Dr. E. M. East, now of the Connecticut Experiment Station. We recommend this publication to the attention of our growers.

During the past year, some very interesting and significant results have been realized in connection with out potato work and some valuable observations have been made. The past year being an unusually dry one over the greater part of Canada, the blight has not been so serious as usual although the yield has been reduced materially in many cases on account of the comparatively large proportion of small tubers.

The question of variety continues to be a serious one owing to the large list from which to choose and to the great difference between them in respect to yield, quality and ability to resist disease. The new beginner is therefore almost invariably advised to secure two or three of the leading varieties from his nearest Experiment Station and test these for one year at least before making a definite choice. On page 80, of the Third Annual Report is given a photograph showing the best types to select.

EXHIBITIONS AND DISTRICT MEETINGS.

The plan of holding an annual exhibition of selected seed at some convenient centre in each of the six districts into which Canada has been divided is proving one of the most powerful factors in maintaining and consolidating the interests of the growers in the several districts that has yet been inaugurated in connection with this organization. Organized originally with a view to providing a place where seed of special

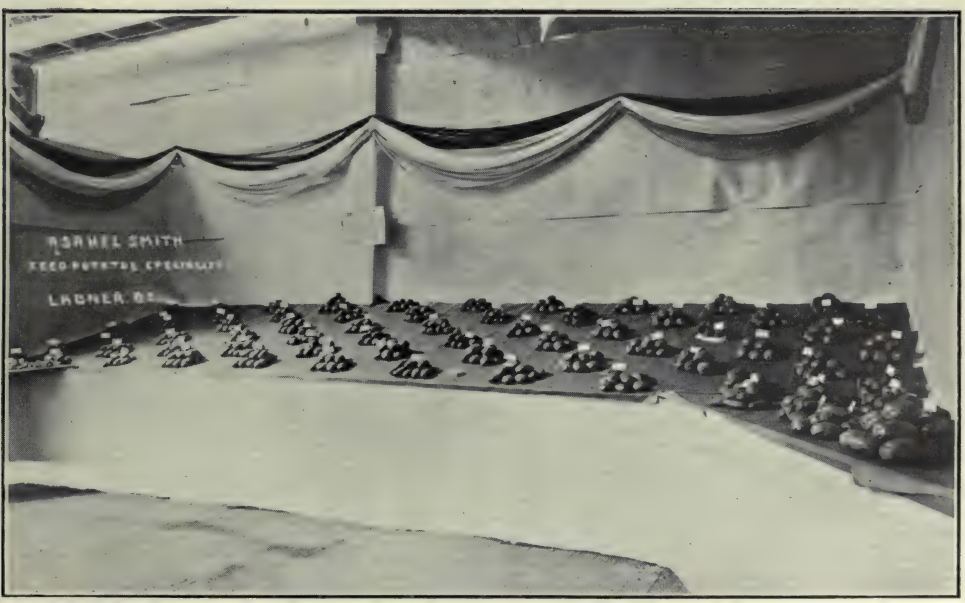


Fig. V.—Exhibit at New Westminster Exhibition, B.C., by a grower who is much interested in potato improvement work as conducted under the direction of the C. S. G. A.

merit might be brought together and placed on exhibition, in order that publicity might be given the work of the Association and that the stocks of the individual grower might receive certain advertisement, these Fairs have gradually broadened out in scope and have become infinitely more comprehensive in purpose. Not only have they served admirably the purposes for which they were originally intended but they have formed a basis upon which is being established a comprehensive scheme for holding annually, meetings of the members of the Association resident in each of these six districts. Since the great majority of the members cannot attend the annual meeting of the Association at Ottawa and since it seems proper to assume that continued interest in the Association as a regularly constituted body will depend to a large extent upon the opportunity which the individual member is given to participate in directing the affairs of the organization, these annual meetings may be made to occupy a very important place.

Furthermore, unless the members residing in the respective districts can be brought together, their work is liable to lack uniformity and precision. By coming together, discussing ways and means by which the work may be made to play a larger part in the routine of yearly agricultural endeavour, systematizing the work and putting it on a more business-like basis infinitely more will be accomplished than by permitting each grower to work in selfish isolation. Since our last meeting convened, district exhibitions have been held as follows, viz.: At Brandon, Man., for the provinces of Manitoba and Saskatchewan, in March, 1908; at St. Hyacinthe, Que., for the province of Quebec, in April, 1908; at Amherst, N.S., for the maritime district, in December, 1908; at Guelph, for the Ontario district, in December, 1908; at Regina, for the province of Saskatchewan, in January, 1909.

On March 9-12 inclusive, of the present year, there will be an exhibition at Brandon for Manitoba members. At St. Hyacinthe, Que., the exhibition of selections from the crop of 1908, by members in Quebec will be held in April. These exhibitions will be reported in the present report. Cash prizes to the extent indicated in the Treasurer's Report have been, or will be awarded in these centres while a number of handsome cups have also been offered. The plan introduced last season by which the inspector's scoring of the standing plots is combined with that given the exhibit which is sent to the Exhibition, in making the final award has worked out admirably while the principle involved is, we think, a very desirable one to encourage.

MANITOBA AND SASKATCHEWAN EXHIBITION.

(Brandon, Man., March, 1908.)

The members of the Canadian Seed Growers' Association, resident in the provinces of Manitoba and Saskatchewan, exhibited their selections of 1907 at the Provincial Winter Fair held at Brandon in March, 1908. While the members from both provinces were invited to exhibit at this Fair, a separate prize list was provided for each province. The new Winter Fair Building offers excellent accommodation for a seed exhibition and every consideration was shown by the management in providing a space for our exhibit. This helped very materially in making the exhibit the success that it was although the unfavourable climatic conditions which prevailed during the previous season made it impossible for the members to put up a display capable of showing the value of the work they are doing. A frost affected the larger part of these two provinces, particularly Saskatchewan, during the early fall of 1907 and as a consequence many of the seed plots were injured. Members were advised to withhold their exhibits unless their grain had escaped injury as it was thought best not to show anything but first class seed. As a result of this the exhibit was much smaller than it would have been had the season been more favourable. However, some very attractive and educational exhibits were put up and keen interest was displayed in the work of the growers in general. As an illustration of the practical value of seed selection it might be mentioned that Registered Red Fife wheat won first place in the general classes open to both provinces.

QUEBEC EXHIBITION.

(St. Hyacinthe, Que., March, 1908.)

The Fourth Annual Exhibition of seed, specially grown and selected by members of the Canadian Seed Growers' Association resident in the province of Quebec, was held at St. Hyacinthe on the 30th day of March, 1908, in connection with the regular spring Seed Fair held annually at that place. Each year this competition is becoming keener as the quality of the exhibits steadily improves. This year the competition in white oats was keenest, and the quality and purity was of a high order considering the rather unfavourable season with which this crop had to contend. The interest taken in this exhibition by those present was noteworthy and resulted in influencing several good growers to take up special work along this line under the direction of the Association.

The amount of money won in prizes is given in the financial statement, while the medal given as a special prize to the grower making the most creditable showing of selected seed was won by Mr. W. L. Davidson, Davidson's Hill, Que., a member who has done much in the interest of the work in the province. In the general class for ordinary seed grown locally there was a large list of entries, while the seed itself was generally of excellent quality showing marked improvement over former years.

MARITIME EXHIBITION.

(Amherst, N.S., Dec., 1908.)

The last Annual Meeting and Exhibition of selected seed for the maritime district was held at Amherst, N.S., November 30 to December 3, inclusive, 1908. Though held in connection with the Winter Fair, at which Live Stock is the predominating feature, yet the Seed Department is coming to constitute one of the most interesting and valuable of all departments represented. As explained in previous reports, the Seed Department not only provides for the accommodation and display of seed grown by members of the Canadian Seed Growers' Association, but for seed grown in the ordinary way. By this arrangement the public is able to compare the two classes of seed and thus to see for itself something of the value of systematic work in seed selection.

Furthermore, by providing the means whereby a larger number of growers may exhibit their wares, though such be of but ordinary quality, the general interest in the Department is, as a whole, greatly increased. The competition this year in practically all classes of crops was very keen. The quality of the exhibits as a whole was noteworthy and served to elicit many favourable remarks on the part of the many visitors who examined the samples.

COMPETITION FOR SWEEPSTAKE TROPHY.

The contest for the special sweepstakes cup offered by the Steele-Briggs Seed Company, Toronto, for the most creditable exhibition of seed in the whole exhibition was exceedingly keen although the closest and by far the two outstanding competitors were Mr. Donald Innes, of Tobique River, N.B. and Richard Creed, of Albion, P.E.I. After careful consideration the judges decided in favour of Mr. Innes, who for the second time has succeeded in winning this trophy.

ANNUAL MEETING OF MEMBERS OF THE ASSOCIATION IN THE MARITIME DISTRICT.

(Amherst, N.S., Dec. 2, 1908.)

In early November, a circular letter was sent all members, applicants and prospective members of our Association resident in the maritime district, as well as others thought to be specially interested in the various problems associated with crop raising, advising them that a meeting of the Association would be held at the Winter Fair Building, Amherst, beginning at 2.30 p.m., December 2. The programme of topics to be discussed was also included in the circular, arrangements having previously been made whereby certain members of the Association had agreed to deal with subjects which had been allotted them. As a means of insuring a good attendance of growers who were not directly affiliated with the Association, but who might be induced to associate themselves therewith, special hand bills were printed and widely distributed throughout the building a few hours before the time for calling the meeting. As a result about 160 persons were present and a most excellent meeting followed.

Rev. J. Hunter Boyd, Waweig, N.B., acted as Secretary pro tem and reported the proceedings of the meeting as follows:—

'The regular annual meeting of the members of the Canadian Seed Growers' Association, resident in the maritime provinces was held in the Fair Building, this afternoon. Prof. M. Cummings occupied the Chair. After a few introductory remarks by the President, who took occasion to eulogize the work that is being done in Canada by the Association in endeavouring to educate the people to a better understanding of the principles which govern the successful production of crops, a paper on 'Some essentials for Success in Seed Growing' by Mr. J. R. Oastler, Minister's Island, N.B., was presented and read by L. H. Newman in the absence of Mr. Oastler. An excellent paper on 'The selection of Seed Potatoes' was next read by Mr. Harry R. Brown, Wallace Bay, N.S., and received many favourable comments. Mr. Brown has done much to show what can be done to improve the potato crop of the maritime provinces. Mr. Richard Creed, of Albion, P.E.I., was the next speaker and spoke on the subject:

SOME RESULTS OBTAINED THROUGH THE CAREFUL SELECTION OF SEEDS.

Mr. Creed first outlined the results of his work in connection with potato improvement and showed how he had realized increased yields and better quality as a result of the systematic choice of superior seed tubers. Going on to his work with oats he claimed that he had secured five bushels more per acre from the use of selected seed than he had from ordinary seed and at the same time he found that 2½ bushels of selected seed per acre was sufficient to sow where 3½ bushels of ordinary seed was usually required. A lively discussion followed this statement, owing to the fact that the question of thickness of seeding has been a question of vital concern to the maritime agriculturist for years. Mr. Geo. H. Clark, Seed Commissioner, who was present, was asked to give his opinion on the matter and, in response, took occasion to speak on the question of '*Stooling in grains.*'

Mr. Clark cited the work that has been done by the Gartons of England and others by way of developing light-stooling strains. 'The virtues of these strains,' continued the speaker, 'exists in their disposition to send up two or three strong vigorous shoots with good heads rather than to produce numerous stolons with mediocre heads. Such strains should, however, be sown comparatively thickly in order to provide a good stand of plants. The standard varieties commonly grown at present are inclined to stool to a much greater degree and are therefore sown much more thinly. Since it is often desirable that the crop should mature early, heavier seeding and the use of light-stooling strains may at such times be resorted to with advantage.'

Mr. Donald Innes was next called upon to read a paper on 'Some gleanings from Field Work in the inspection of Seed Plots of fellow members.' Mr. Innes based his remarks upon experiences encountered while inspecting seed plots in Prince Edward Island during the summer of 1908.

Mr. S. J. Moore, Representative of the Seed Branch in the maritime district next discussed the utility of 'The special Seed plot as an educator' and showed the influence which is being exerted on the agricultural life of the people by the distribution of special plots here and there throughout the country.

Mr. L. H. Newman, Secretary of the Association, who was asked to make a few remarks prior to adjourning the meeting, took occasion to review the agricultural conditions which prevail in the maritime provinces generally and to point out how the special lines of work which are being carried on by the Seed Growers' Association could be justified and made to fit in with the general farm practice. In closing, he congratulated the members of the Association residing in the maritime provinces for the intelligent interest they are taking in this line of work and for the degree of success which they have attained.

A vote was made, seconded and carried, conveying the thanks of the audience to those who had contributed toward the splendid success of the session. The meeting then adjourned until next year.

[Signed.] J. HUNTER BOYD,
Secretary pro tem.

Most of the above mentioned papers and addresses will be published elsewhere in this Report.

ONTARIO EXHIBITION.

(Guelph, Ont., Dec. 1908.)

As explained in previous reports the annual exhibition of specially selected seed for the Ontario district is held in connection with the regular Seed Department of the Provincial Winter Fair which convenes each year early in December at Guelph. Beginning under very discouraging and humble circumstances, this Department has grown until it has come to constitute one of the chief attractions of the Fair. Heretofore the Department was divided into two sections, one of which provided accommodation for the exhibits of seed specially selected by members of the Canadian Seed Growers' Association while the other included all seed not eligible to be shown in this special class. At the last Fair, another division was added to the Department providing accommodation for two bushel samples taken from the prize-winning fields in the field Competition held throughout the province during the previous summer. This addition proved most valuable, bringing together as it did 76 exhibits of White Oats in one section. With the additional number of exhibitors the interest in the whole department was greatly enhanced. The prizes for this new division were paid by the Agricultural Societies Branch of the Ontario Provincial Government under whose auspices the field competitions were held. Prof. Klinck, of Macdonald College, acted as judge in this division, while Mr. Jno. Buchanan, O. A. C., Guelph, judged the exhibits in the C.S.G.A. and open classes. Regarding the quality of these exhibits, Mr. Buchanan makes the following statement :'To those who had the opportunity of attending the Provincial Winter Fair at Guelph, in December, it must have been a pleasure to note the decided improvement over previous years in the exhibit of Farm Seeds. This year the seed display was brought down from its old place at the west end of the first floor to a much better location on the ground floor, and, as a result, a great many more people than usual examined the exhibits and were benefited by what they saw.

' There were, in open competition, 144 exhibits and in the special classes for members of the Canadian Seed Growers' Association 42 exhibits, making a total of 186. The majority of these had been well prepared and many of them were of excellent quality. One bag of White Peas was the finest exhibit of seed grain of any kind that I have ever seen at any show. Some of the members of the C. S. G. A. deserve great credit for the neatness, fine appearance and excellent quality of their group exhibits, but a few might still make considerable improvement.

' In the potato classes there still seems to be the tendency to place on exhibition the largest tubers obtainable, in the hope of thus winning first prize. This, I think, should be discouraged, as abnormally large potatoes are not desired by any consumer nor demanded by the markets, nor have they the quality of the more ordinary sized tubers. There were, however, many very fine lots on exhibition.

' Now that real live interest in the seed exhibits is being evinced, and the exhibitors are entering first-class seed, the exhibition authorities should do all in their power to help on the good work by furnishing the best possible facilities for displaying the seed to good advantage. Already good prizes are offered in all classes, and, judging

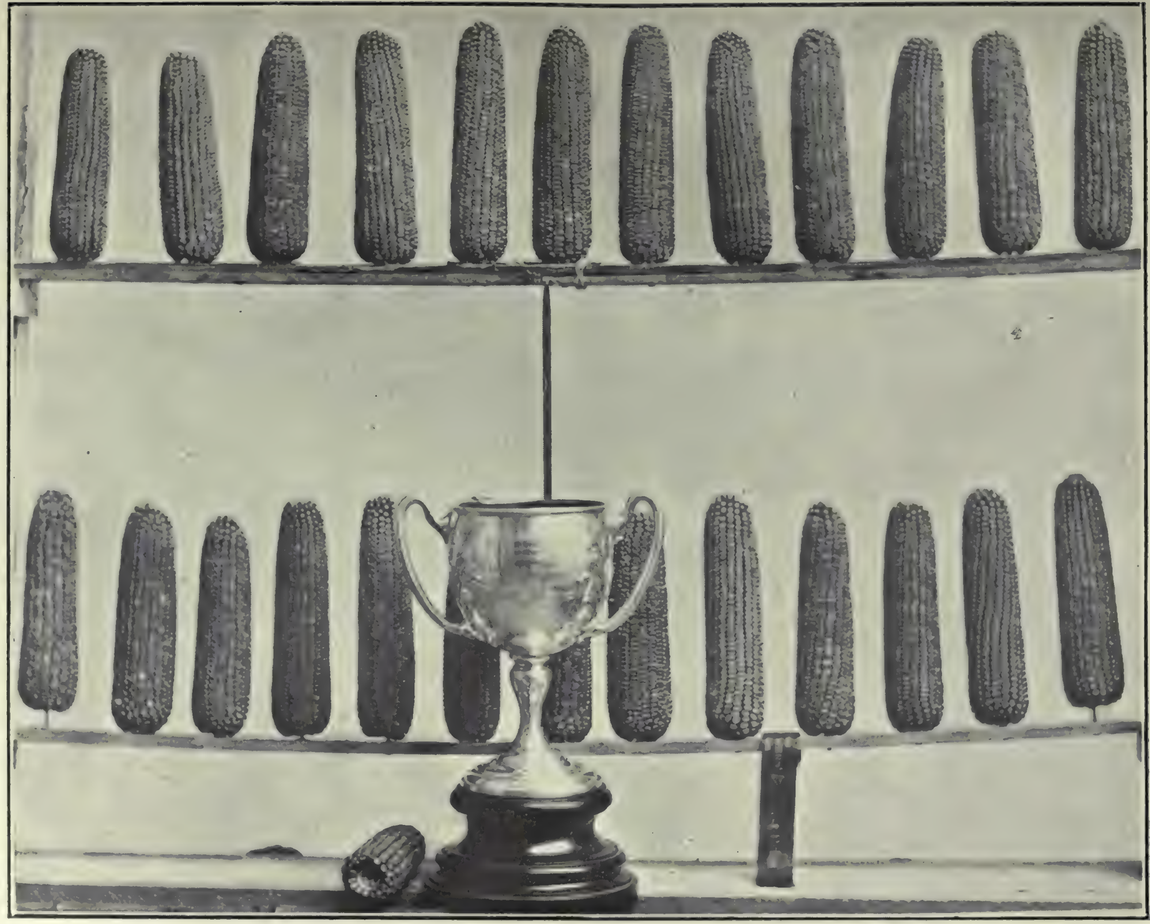


Fig. VI.—Exhibit of Reid's Yellow Dent Corn which won the Klinck Trophy for the best 25 ears of Dent Corn, any variety, grown in Ontario in 1908 according to the rules of the C. S. G. A. Grown and exhibited by Mr. G. W. Coatsworth & Son, Kingsville, Ont.

from the advance made during the past few years, I am of the opinion that in a short time the Seed Department will become one of the most important departments of the Provincial Winter Fair.'

WINNERS OF SPECIAL PRIZES.

Owing to the keenness of the Competition, special mention should be made of the winners of the different cups offered in the various classes. The following is the list of successful competitors for special trophies:—

(1) Mr. G. W. Coatsworth & Son, Kingsville, Ont. Klinck Trophy for 'best 25 ears Dent Corn grown in Ontario in 1908 according to the rules of the C. S. G. A.'

(2) Mr. Ed. Smith, Ridgetown, Ont., winner of 'The Bate Cup', given for the best 25 ears of Flint Corn grown in Ontario, according to the regulations of the Association.

(3) Mr. Duncan Carmichael, Jr., West Lorne, Ont., winner of the 'Hodson Trophy,' given the member of the Association making the most creditable showing of selected seed for the whole exhibition.

These cups are described in detail on page 25 of the 4th Annual Report of the Association. Photographs of the winning samples of Dent and Flint Corn produced in 1908 are shown in figs. VI. and VII. respectively of this report.

SPECIAL MEETING FOR ONTARIO GROWERS.

During the past three years the Fair Board has set aside a special session of the time allowed for the regular Fair Programme for the discussion of topics relating to seed growing, crop raising, etc. To this meeting all members of the Association have been invited by special letter, it being explained that certain officers of the Association would be present to explain either privately or in public any question bearing on the work of the Association which might arise. In future, it is proposed to hold a special meeting for the benefit of the members of the Association resident in Ontario and others who may be specially interested in our work.

SASKATCHEWAN EXHIBITION.

(Regina, Sask., Jan. 26, 1909.)

Reported by Mr. Jno. Bracken, Regina, Sask.

'The Grain Show passed off most successfully. There were in all something over 130 entries and these came from all parts of the province. We have received many congratulations on the character of the whole exhibit.

'The C. S. G. A. section was, as we expected, not very well filled, F. J. Dash, of Hillesden and Sergt. Major Coles, of Moffat, being the only two persons making an exhibit. We gave the others every opportunity to make an entry, but frozen crops and other causes resulted in a very poor show. It is to be regretted that this is so since there is such a great field of usefulness for your Association in this province. We shall hope that as the time goes on more interest and enthusiasm will be shown by your Saskatchewan members and applicants in this work.'

MANITOBA EXHIBITION.

(Brandon, Man., March, 1909.)

(Included for publication after the presentation of the regular annual report.)

The exhibition of specially selected seed for the province of Manitoba was held in connection with the Winter Fair at Brandon, Man., March 9-12, inclusive, 1909, and was an unqualified success. The exhibits were more numerous and the quality better than ever before, while the interest taken in the display by the general public was most gratifying and bore ample evidence both of the attractiveness of the exhibition and of the high place which the Association is coming to fill in Western Agriculture.

The prizes offered were as follows: $200 by the Canadian Seed Growers' Association; $50 by the Manitoba Grain Growers' Association; Sweepstakes Trophy (Silver Cup) by the 'Canadian Thresherman and Farmer' and $25 by the C. P. R.

The actual awards were as follows:—$77 by the C.S.G.A.; $24.50 by the M. G. G. Assn., and the 'Thresherman' and C.P.R. Specials. The Cup was won for the second time by G. M. Yeomans & Son, Alexander, Man., while the C.P.R. prize of $25 for the best 2 bushels of Red Fife wheat, the product of Registered Seed, went to Thos. Thomson, Roden, Man. Mr. Thomson has won this prize for the second time and deserves special praise for the splendid success he is meeting with as a grower of high class seed.

Special mention should also be made of the creditable and most artistic display of plants and seed by Mr. G. Yeomans, sr. The arrangement of this display was most artistic, the whole effect being emblematic of that high position which Agriculture occupies in Western Canada. Mr. Yeomans is to be highly congratulated upon the quality of his handiwork and upon his ability to draw the attention of the public back to first principles in the production of seed.

Fig. VIII. is a photograph showing the arrangement of a part of the C.S.G.A. exhibit.

FIRST ANNUAL MEETING OF MEMBERS OF THE ASSOCIATION IN THE DISTRICT OF MANITOBA.

(Brandon, Man., March 11, 1909.)

A meeting of the members of the Canadian Seed Growers' Association, resident in Western Canada, was held in the Winter Fair Building, Brandon, Man, March 11, 1909. Mr. Jno. Mooney, Vice-President of the Association, occupied the Chair. The meeting was called to order at 3 p.m., the chairman taking occasion to express his pleasure at meeting so many members of the Association and other interested growers.

The plan of bringing together, once a year, the members resident in the different districts or provinces for the purpose of discussing the various local problems associated with the work of seed growing was outlined. It was also explained that the Board of Directors of the Association had, at the last annual meeting, favoured the plan of holding a business session in connection with these meetings in order that the members might have an opportunity of exercising their voice in directing the affairs of the organization.

In accordance with this intimation, the chairman suggested that a Resolutions Committee be appointed in order that any recommendation or resolution which the members might see fit to propose for presentation before the Annual meeting at Ottawa might be referred to a deliberate body for special consideration. It was therefore moved by Mr. J. L. Henry, seconded by Mr. A. Cooper, that a resolutions committee consisting of Messrs. W. R. F. Collis, G. Yeomans and T. J. Scott, be appointed.—Carried.

The Secretary of the Association was next called upon to present a report of the work of the Association in Western Canada. This report consisted of extracts taken from the general report presented on the occasion of the Annual Meeting at Ottawa in February, and which concerned the work of the West particularly. A discussion of some length followed the presentation of this report and several matters of importance were referred to the resolutions committee.

Following this discussion, the following papers were presented:—

(1) 'Some of the factors which influence the productive capacity of Seed.'
Mr. Geo. Bradshaw, Morden, Man.

(2) 'The Special Seed Plot vs. the General Field as a Source of Good Seed.'
Mr. W. A. A. Rowe, Neepawa, Man.

(3) 'The operating of a Special Seed Plot from Seed Time till Harvest, with Comments on the best method of Selecting, Threshing, &c.'
Mr. J. C. Smith, Darlingford, Man.

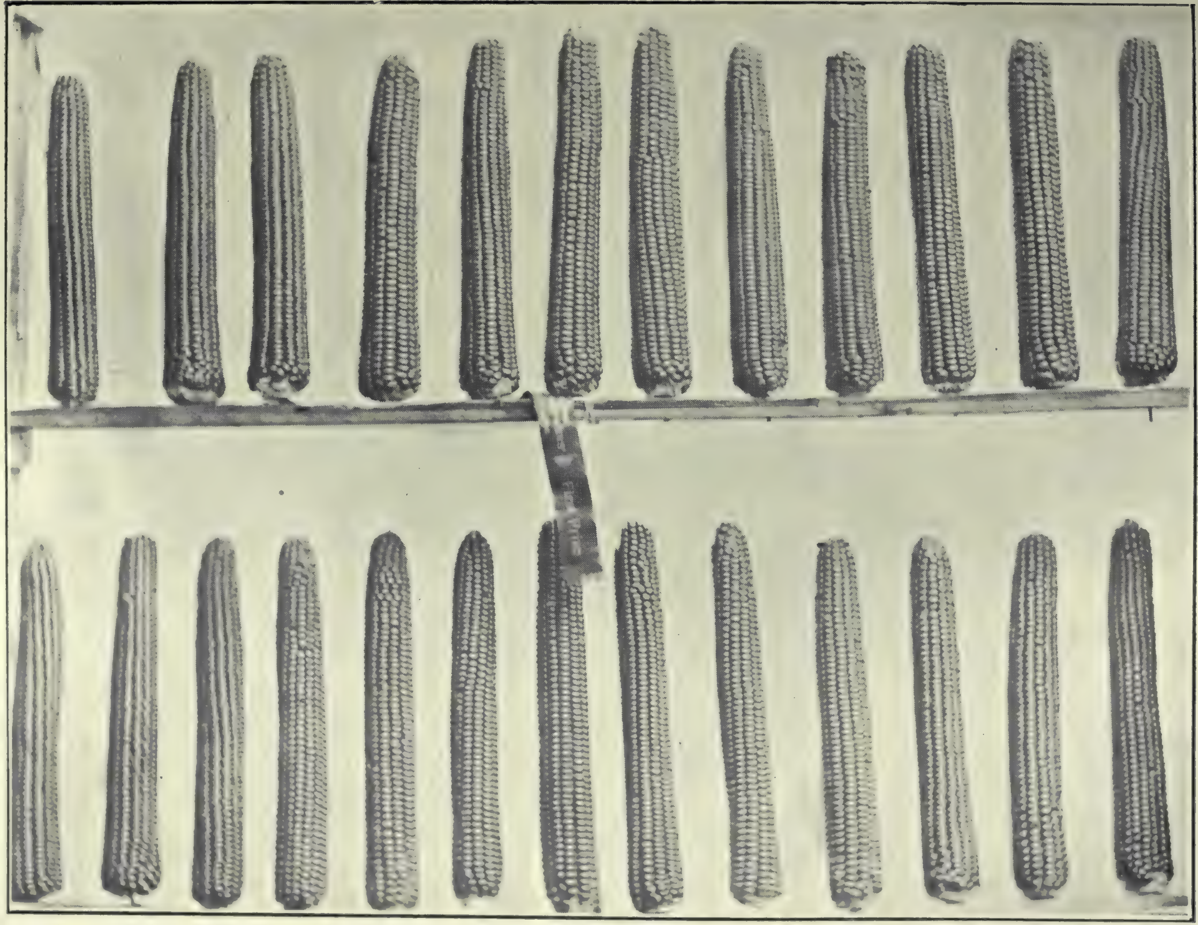


Fig. VII.—Exhibit of Compton's Early Corn which won the Bate Cup," for the best 25 ears of Flint Corn, any variety, grown in Ontario in 1908 according to the rules of the C.S.G.A. Grown and exhibited by Mr. Ed. Smith, Ridgetown, Ont.

(4) 'Some Results obtained through the Careful Selection of Seeds.'
Messrs. T. Turnbull, Manitou, Man.; Geo. Dow, Gilbert Plains, Man.
(5) 'The scope open for the production of highly bred seed in Manitoba.'
Mr. Jno. Mooney, Valley River, Man.

(For these papers see page 106 of this Report.)

Following these papers, a lively discussion took place regarding certain matters of interest which were brought out in connection with the subjects presented. Mr. Jas. Murray, of the Experimental Farm, Brandon, Man., and Mr. Jno. Bracken, of Regina, Sask., took part in this discussion and placed themselves on record as strongly supporting the good work that is being carried on by the Association in the West.

Mr. Bracken, as representative of the province of Saskatchewan, spoke as follows:—

Mr. President and Gentlemen,—I wish to express my pleasure at having an opportunity of listening to the addresses and discussions on the programme of this first meeting of the Canadian Seed Growers' Association in Western Canada. It is an inspiration to meet again the men who are doing the real work of crop improvement in Manitoba and Saskatchewan, and to renew the acquaintance of members whose seed plots I inspected some years ago. Your first gathering has been a success and an inspiration, and will, I am sure, be the means of encouraging every member to still greater achievement, of greatly increasing our membership and of placing the Association on a very much higher plain in the minds of Western farmers. Your work is directed along sane, proper and practical lines, and great improvement, as has been pointed out here to-day, has resulted from your efforts. A great plant breeder has said that 'Selection is the surest and most powerful instrument that man possesses for the modification of living organisms.' That instrument is available to every farmer in Manitoba and Saskatchewan. The possibilities before us are great, and I only hope we, as members of the Canadian Seed Growers' Association, will not fail to grasp those that are so near at hand.'

The report of the resolutions committee was next presented by Mr. T. J. Scott, as follows:—

'Mr. Chairman and Gentlemen,—Your committee on resolutions begs to report as follows:—

(1) In the opinion of your committee the work of the Association in western Canada would be materially encouraged were the Association to increase the amount of the prize money offered for the sheaves of plants selected from the breeding plots of the various kinds of crops grown.

(2) It is recommended further that the Association provide its members with a badge or button for use at special conventions and meetings.

(3) That steps be taken to secure, if possible, better rates on seed returned from this exhibition.

(4) In the opinion of your committee, each member in good standing should, as a matter of moral obligation, prepare an exhibit of selected seed for the annual exhibition of such seed held in his province.

(5) That the practice of reserving each year a one pint sample of seed from the Improved Seed Plot for the sake of comparison be encouraged among our members.

(6) Resolved that the thanks of the C. S. G. Ass'n. be tendered the Executive of the Brandon Winter Fair for the assistance they have rendered in advancing the work of our Association by providing the means whereby the members and others might meet together and discuss their work, and that the products of their work might be placed on exhibition.'

(Signed,) T. J. SCOTT,
W. R. F. COLLIS,
G. YEOMANS, Jr.

Moved by Mr. Bradshaw, seconded by Mr. Henry, that the report of the Resolutions committee be accepted and the various recommendations considered seriatim.—Carried.

The consideration of these recommendations resulted in each being unanimously adopted and carried.

Before closing the meeting, several of the members expressed themselves openly as highly appreciating the efforts which had been made to provide the means whereby they might come together and discuss their work and hoped this plan would be carried out and perfected in future years.

The meeting adjourned at 5.30 p.m., March, 11, 1909.

QUEBEC EXHIBITION.

(St. Hyacinthe, Que., April, 1909.)

(Included for publication subsequent to the presentation of the regular annual report.)

The fifth annual exhibition of selected seed produced in Quebec by members of the Association was held at St. Hyacinthe on the 19th day of April, 1909. The showing made at this exhibition surpassed that of any former year, although there is still plenty of room for improvement. In the province of Quebec, farmers are inclined to harvest their crops before they are fully matured and as a result exhibits of seed at Seed Fairs are very often composed of samples of immature grain. This was quite noticeable in the exhibits displayed by members of the Association, who have since been advised of the objections to such practice. Some of the samples were not cleaned so well as they might be and should be for seed purposes. The effects of frost were also quite noticeable in some samples from the northern districts. In other exhibits the type was found to be variable and in some instances there were evidences of the presence of foreign varieties.

Some very creditable samples of corn were shown, one sample being of the White Cap Yellow Dent variety which was perfectly matured. From this and other evidences it is clear that seed corn can be grown satisfactorily in some parts of this province at least.

The Cup offered by Wm. Ewing Seed Co., Montreal, to the farmer making the most creditable showing of seed for the whole exhibition was won by Mr. Stanislas Lafrenaie, St. Jude, Que., who is a worthy member of our Association.

Special mention should be made of the splendid exhibit by Mr. W. L. Davidson, of Davidson's Hill, Que. Mr. Davidson easily took first place among the exhibitors in the C. S. G. A. classes. Since he did not exhibit in the open classes, however, and since both classes or divisions were considered in the awarding of the sweepstakes trophy, Mr. Davidson had to give way to Mr. Lafrenaie.

In the afternoon of the above date, a meeting was held for the discussion of topics pertaining to crop raising, seed growing, rotation of crops, etc. This meeting was addressed by Messrs. Coté, Grisdale and Lavallée.

EXECUTIVE WORK.

During the past year the progressive policy adopted by this Association has been carefully followed. As a means of giving publicity to the work, a special circular was prepared last spring setting forth the claims of the organization in concise and intelligible form. The Constitution and By-laws were also included in this publication. The use of such circular precludes the expense of printing these by-laws each year in our Annual Report and is a more economical method of bringing the work before the public.

The usual number of circular letters have been issued during the year as a means of directing the work step by step from seed time till harvest. The regular Blank Forms with some minor improvements have been issued as usual while special forms for the recording of field notes have been devised and issued for use in connection with our potato work.

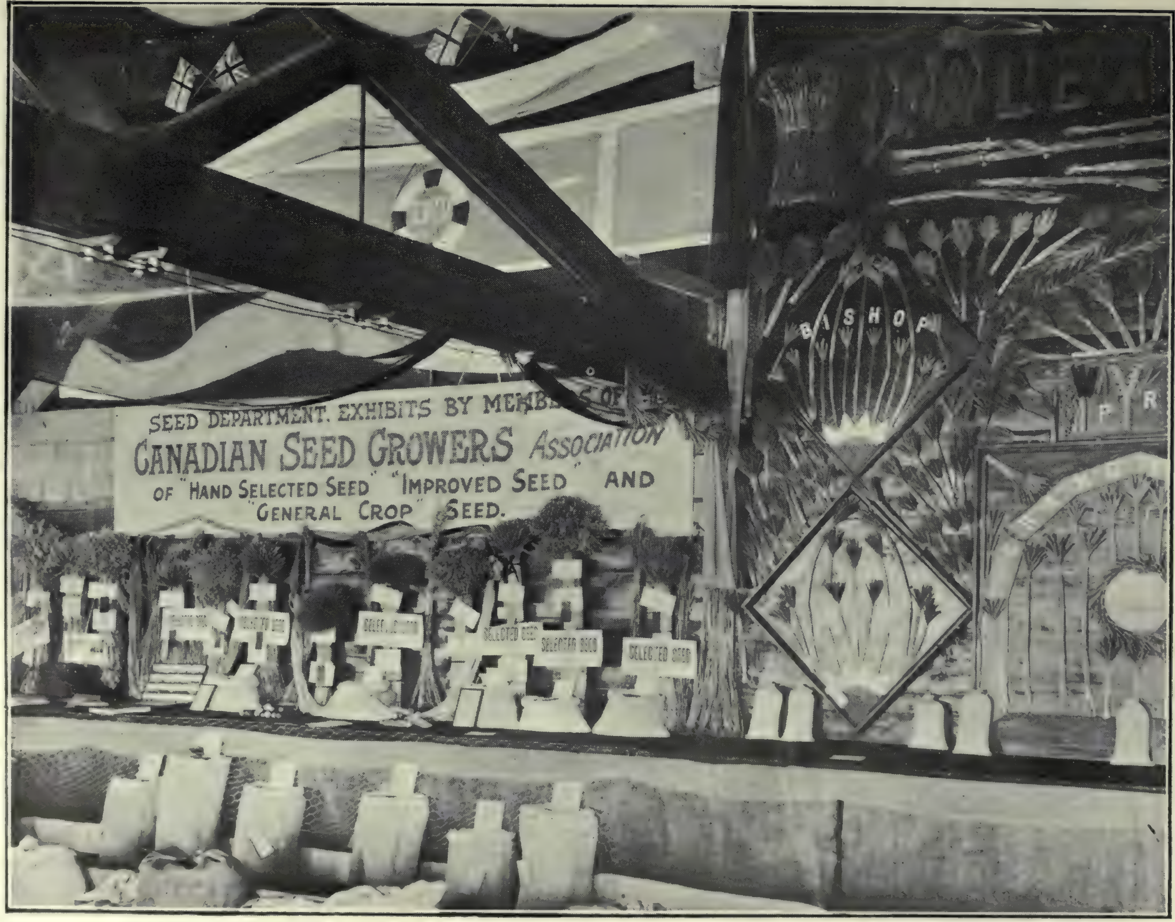

SEED DEPARTMENT. EXHIBITS BY MEMBERS OF
CANADIAN SEED GROWERS ASSOCIATION
OF "HAND SELECTED SEED" "IMPROVED SEED" AND
"GENERAL CROP" SEED.
BISHOP
SELECTED SEED
SELECTED SEED
SELECTED SEED

Fig. VIII.—Part of exhibit of selected seed grown in the Manitoba district and shown at the Winter Fair, Brandon, in March, 1909. To the right of the picture is shown a part of a specially attractive exhibit prepared by Mr. G. Yeomans, Sr., Alexander, Man.

Practically every grower has submitted a sample of heads, ears, pods or tubers as the case may be, of the strain with which he is doing special work while those offering seed for sale have forwarded an official sample of one pound. The examination of these samples and the recording of the information deduced has taken considerable extra time but is we think justifiable.

With a view to keeping the work constantly before the public, timely articles have been prepared and published in the various papers and Agricultural journals throughout Canada although time has not permitted us to indulge as freely in this method of advertising the work as we should like.

THE TRADE IN REGISTERED SEED AND THE ISSUING OF CERTIFICATES OF REGISTRATION.

The number of pounds of seed produced in 1908 for which certificates of registration have been issued is as follows: 93,700 pounds of General Crop Registered Seed, 1,800 pounds of Improved Registered Seed and 140 pounds of Hand Selected Seed. The number of statements of transfer returned to date show that 5,800 pounds of Registered Seed accompanied by certificates have changed hands during the past year. Since the greater part of last year's crop is still in the hands of the grower, we cannot give an exact report of the quantity of seed that will be exchanged. The number who, in sending in their reports each year, state that all their surplus stock of selected seed has been sold has increased to such an extent that we now have very little seed left to catalogue. So great has become the demand for this seed that our catalogue of three or four years ago has been reduced to a mere leaflet giving the names of those who may have a small supply of seed still left for sale.

The increased demand for high-class seed, however, has not gone unnoticed as several growers are coming to realize the opportunities for financial gain and are going into the work quite strongly. In a very short time we may expect to see a substantial supply of seed available to meet the ever increasing demands of a high-class trade.

In concluding this review of the progress that has been made by the Association during the past year, it is gratifying to feel that we are gradually but surely rising to a higher plain. Forging ahead in intelligence we are coming to see the dim dawn of an enlightened future in many of the things which at first remained closely veiled. As time passes the pathway becomes clearer, though not always smoother, and we are able to shape our course with greater safety and precision. While we may be inclined to chafe under the restrictions imposed upon us by the necessity of going slowly yet we are coming to see that if any substantial accomplishment is to be effected there must be a wise conservatism. Our first concern, moreover, is not the isolating of the best types of plants but the discovering and encouraging the best class of men. We need first of all not only men of intelligence but men possessing the highest integrity and who may be depended upon to deliver goods of the very best quality. As an Association we have been exceedingly fortunate thus far in securing such men. Our present need is for more of these.

Our work and influence as an Association will be effective only in so far as we are able to sustain intimate relations with the man on the land. In the quality of the reaction upon these men is to be found the supreme test of the success or failure of the movement which we seek to promote. It is gratifying to feel that our Association is exerting a healthy influence throughout the rural districts of Canada and that it is contributing something toward the permanent elevation and dignity of Agriculture as a profession.

CANADIAN SEED GROWERS' ASSOCIATION.

TREASURER'S REPORT, 1908.

As treasurer of the Association, I beg to submit the following financial statement for the period between February 4, 1908, and February 4, 1909:—

RECEIPTS.

To balance from last year	$ 909 88
To appropriation from Dominion Government for the current Association year	3,000 00
Total	$3,909 88

EXPENDITURE.

Salaries		1,535 03
Travelling expenses		470 98
Printing		342 92
Exhibitions of selected seed:—		
Maritime Exhibition (Amherst, Dec, 1908)	$182 58	
Ontario Exhibition (Guelph, Dec. 1908)	184 55	
Brandon Exhibition (March, 1908)	71 55	
Saskatchewan Exhibition (March, 1908)	17 45	
St. Hyacinthe Exhibition (April, 1908)	99 11	
Saskatchewan Exhibition (January, 1909)	24 00	
Incidentals	9 98	
		589 22
Office supplies		98 10
Expense of convening the 4th Annual Convention and of delegate to A. B. A. Convention		401 75
Sundries		0 50
Total		$3,438 50
Balance		471 38

(Signed.) L. H. NEWMAN,
Treasurer, C.S.G.A.

We hereby certify that we have examined the accounts of the Association and find them correct.

[Signed.] L. S. KLINCK.
F. C. CHITTICK,

The CHAIRMAN.—We have heard the report of the Secretary of the Association, which I think covers, as well as could be expected in the time allowed, the work of the Association for the past year.

I will call on Mr. T. G. Raynor, Ontario Representative of the Seed Branch, to give a short report on the general work of seed improvement as conducted in Ontario.

(For Mr. Raynor's paper see page 61.)

The CHAIRMAN.—Mr. Raynor represents Ontario for the Seed Branch both in the work of inspection of seed plots and in the inspection of seed that is put on the market.

Mr. COTÉ, representative in the province of Quebec, was next called on.

(For Mr. Coté's paper, see page 60.)

The CHAIRMAN.—I will now call on Mr. Moore, district representative for the Maritime provinces.

(For Mr. Moore's paper see page 59.)

Mr. INNES.—It is safe to say that the future of this work is assured. When I began seed work eight years ago any kind of seed that was cheap was good enough. The Association has put up the price, but it has put up the quality as well. To-day nothing is too good. Last summer I had four individuals come specially to see the work I was doing. The farmers want to exchange seed with me, but I do not want their seed. This year I cannot supply the demand. The Association is doing a great work in providing an object lesson for the farmers.

On my tour last summer, inspecting field competition crops, I found a great deal of oats of fine quality, but with many empty glumes in the heads. What is the reason for that?

Prof. KLINCK.—I cannot answer that question to my own satisfaction. I am, however, inclined to the belief that weather conditions are largely responsible. The white papery chaff mentioned is the empty glumes of the oat spikelets. As these blighted glumes are generally found at the base of the heads, it is thought by some that during showery weather, especially if followed by a hot bright sun, that the tender organs of reproduction in the oat flower at the base of the head are scalded and so fail to develop. On the other hand, we know that a moderately moist, cool and rather prolonged heading period is conducive to the formation of more spikelets to the head and of more flowers to the spikelet. Hence we would expect that in a very dry season, such as the past was, we would find many sterile flowers, and as the ones at the base of the head are the last to form, naturally they would suffer most.

If you examine the base of a head of wheat you will generally find one or more empty spikelets, but as the spikelets in wheat are sessile this fact is not so readily noticed.

Mr. LÉON GÉRIN.—To my mind, the success of this great movement for the growing and more general use of high-class seed throughout Canada rests, and, for a good many years to come, will rest largely on the adequacy of the supplies of such seed available to the farming community as a whole. That is the conclusion I have been led to, as the outcome of some efforts made to induce farmers in my vicinity to take up the practice advocated by this Association. Particularly during the Dominion exhibition held at Sherbrooke in 1907, when I had charge of the Association's exhibit there, it was noticeable how promptly the interest would flag and farmers would turn away from us when told that we had no seed for sale, but only information to give and principles to expound, besides giving the addresses of a few farmers who might or might not have just the seed grain required.

How can that serious difficulty be overcome? A few days ago, I came across an account of the work being carried on at Svalöf, in Sweden, and here are the main features of that remarkable organization: (1) A farm, which is a purely business concern, the outcome of private enterprise, run on strictly business lines, and having for its specialty the growing and selling of high grade cereals; ((2) A laboratory, a staff of scientific experts, entirely distinct from, and independent of, the business concern, yet working in close union with it, subsidized by the government, the farmers' institutes and the business concern, and having a strong hold on the latter, inasmuch as the farm is bound to grow, propagate and distribute only such varieties or strains as are turned out or recommended by the laboratory of scientific experts; (3) Both farm and laboratory kept in close touch with the bulk of the farming community through the co-operation of farmers' institutes and the handling of seed grain.

It struck me at once that such an organization, while in no way interfering with those excellent factors of success we already possess, would be of great help in the work we are carrying on. Of course, there are a great many ways in which the establishment of such a farm might be brought about in this country of ours, whether as a commercial venture, as the result of private benefaction, or otherwise, and this is not the time for discussing such a wide subject. However, I thought it desirable to draw the attention of our members to this want, which will have to be met in some way, if the greatest drawback to the progress of our work, the insufficiency of the supplies of high-grade seed, is to be overcome.

Mr. Macoun.—I am much interested in the work of the Association; in fact, I am carrying on some work for the Association in the breeding of potatoes. This is our second year. I would like to say a few words about this work. I think the system the Association has adopted for the improvement of potatotes is a good one.

I believe we shall develop more productive and more permanent strains of potatoes by this system than by your methods of selecting seed grain. During the last three years, 1906-8, we have had three extraordinary dry summers, and our potatoes at the farm have seemed to lose vitality each year. This year by good cultivation we were able to hold them about where they were last year. I am more and more impressed that the time is coming when the Ontario potato growers will occasionally import their seed from the maritime provinces. In these provinces, the summers are cooler and droughts, such as we often have in Ontario, rarely occur so that the vigour of the potato is maintained. We have had good results by importing from Nappan, N.S., potatoes of the same varieties we have been growing here and which have been subjected to the droughts of Ontario for 10 or 12 years or more. These Nova Scotia potatoes outyielded our own by far the first year. We planted the seed again last year, and again they greatly outyielded ours. The vigour from the Maritime seed was still marked in the crop. These results are confirmed by experiments in the old country. It has been found that where seed has been obtained from the south of England, Scotland and Ireland and planted side by side, the seed from Scotland and Ireland will produce nearly twice the crop as that from the south of England. The climate of Scotland and Ireland is cooler and the potato develops better. It wants a comparatively cool, moist climate; then it is more vigorous.

The Chairman.—Possibly some of the members of the Association who are here do not know that Mr. Macoun is probably the best authority on potatoes we have in Canada, perhaps in North America. We can, therefore, appreciate the value of the suggestions he has made.

We have with us three representative seedsmen: Mr. McDonald, of Ottawa; Mr. Walter Steele, of the Steele, Briggs Seed Company, Toronto, and Mr. Herman Simmers, Toronto. There are very few people in Canada who have done more towards guiding agricultural progress than have our seedsmen.

Mr. McDonald.—I have always been impressed with the possibilities of improvement by selection of Seed Corn, Potatoes and all Farm and Garden Crops. I believe the matter of selection to be one of vital importance to the best interests of every farmer, market gardener and seedsman in our Dominion, and to this end, it is quite apparent that the efforts of this Association is yielding a marked and wide influence.

It is quite evident, I think, to every seedsman in this country, that our Canadian farmers manifest a greater appreciation for quality to-day than ever before. This, I believe, is largely due to education, and that education, I think, can be largely attributed to different elements, among which might be mentioned our experimental farms and stations, agricultural societies, work as conducted under the supervision of this Association, and lastly, and by no means the least worthy of mention, is that of our seedsmen and growers, both at home and abroad. In making mention of our seedsmen in this connection, I am sure you will agree with me when I say, that they have been largely responsible for the introduction of the majority of the leading varieties both in Farm and Garden Seeds, and as a consequence have done much in bringing the quality of most crops to their present high standard.

From the remarks already made in our hearing by other speakers, it is quite apparent that the problem of improvement is by no means an easy one of solution, and we know quite well, that even the best directed efforts are not always crowned by success, partly for the reason, that the best possible selection for one locality, quite frequently, proves disappointing in another. We know that many persons hold the opinion that a renewal or change of seed is absolutely necessary. This may or may not be the case, depending upon existing conditions. In a locality where a certain type can be not only maintained but improved by selection, it has been shown, time and again, that a change of seed is not only unnecessary, but also unwise, and it would seem that a fairly safe course to follow, would be to obtain stocks from a locality where they attain greatest perfection.

It is here that I think the seedsman renders a service of great value, particularly in so far as he is continually seeking, and quite often at great expense, varieties which to his mind, are apt to prove and, in some cases, do prove of inestimable value to the agricultural products of our country as a whole.

I have sometimes thought that, by the working of different worthy organizations, akin to this Association, that there is possibly a tendency to discriminate against the seedsman. If this is the case, it seems clear to my mind, at least, that it might better be otherwise, if for none other than the reasons I have already set forth.

Concerning your seedsmen, I may say, that I believe as a whole, they are constantly exercising every possible care in the selection of all stocks, their stocks, as a rule, being the product of the most expert and intelligent growers of long experience, and consequently are not, as is sometimes the impression, picked up here, there and everywhere in the open markets.

I migh say, in conclusion, that I am in hearty sympathy with the work of this Association, in so far as your policy pertains to the selection and improvement of all Farm, Field and Garden Crops, for in this, your object is highly commendable and quite on a par with that of the average seedsman.

Mr. STEELE.—This Association has done excellent work in encouraging growers to select the best products of their fields from year to year to be used as seed stock. The results of this educational work are felt by the seedsmen. Some years ago, the cheaper grades of Clover and Timothy Seed were most largely called for but, latterly, the heaviest demand has been for the best stocks obtainable. The same interest is also being shown in securing the best grades of seed for Root Crops and Vegetables, as the farmer and gardener are at last being convinced that a few cents saved in the cost of their seed, may mean a poor crop when harvest time arrives. This applies with even greater force to Root and Garden seeds than to Grain and Clover, as it is practically impossible to tell by the appearance of the seed what the quality of the product will be. It is therefore imperative that stocks should be secured from reliable houses, who conduct careful experiments yearly of seeds secured from the best growers in the world, discarding the poorer strains and securing supplies which will give the best satisfaction to the growers in this country.

It can readily be seen that such experimental work is expensive and that firms making these tests must secure slightly higher prices for their supplies than houses who do no experimental work. The grower must decide which will give the best returns.

A resolution has been passed to request the various Experimental Farms throughout Canada to endeavour to produce seed from various crops of roots and vegetables and compare the products with crops from imported stocks. While these experiments will be interesting and are in line with other work done by these institutions, I might say, from the experience of our own firm with similar experiments, that results are not likely to prove satisfactory. Occasionally in favourable seasons, good samples of seed can be produced, but when the attempt is continued it is sure to end in a total failure every few years, and while it might be possible for individuals to produce sufficient for their own requirements, it would be practically impossible to produce root or garden seeds in merchantable quantities in this country, and, owing to high price of labour and excessive risk of losing crop, prices would be exorbitant. It can safely be predicted that the best average results for a term of years will be secured from seeds of this class, produced in countries where climatic conditions are more favourable than in Canada.

Mr. SIMMERS.—It is an admitted fact among seed merchants that it requires quite a considerable capital in order to grow root seeds. So far as I can learn, the endeavours of the different growers, who have attempted this work, have fallen down the second or third year, there being no money in it and they have let it drop.

Mr. GIGAULT.—This forenoon, it was contended that home-grown seed was preferable to imported seed or to seed grown in a district different from the one where the plant was to be grown. According to the opinion of Mr. Macoun, the climate has a good deal to do with the quality of the seed. I know it is contended that we cannot grow good cauliflower seed here, but must go to other countries for that seed. This morning, certain growers contended that onion or turnip seed grown in Canada was preferable to imported seed. I would like to have the opinion of importers of seed as to this contention.

Mr. Raynor.—I have found three men in this province, who have been growing only one variety of potatoes for 25 years. They say they are able to produce better potatoes now than at first. Another man, who had been using a certain variety for 25 years, found this variety to be deteriorating. One man in particular remarked that in the 25 years he had experimented with as many varieties, but there was only one variety that approached his selected variety. The teaching of the Ontario Agricultural College after 12 or 14 years experience is that yields may be improved by selection. In connection with our system of work we are preaching the doctrine of sticking to one variety. We do not want to have confusion in teaching. I agree with Mr. Macoun that a change may be necessary when climatic conditions are likely to affect the benefits of selection.

Mr. Macoun.—I firmly believe seed should be grown in the same climate year after year, if you want early maturity. If it is a question of yield, the climate that will give the largest yield in the average year is the climate that will give us the best seed. I fancy the reason cauliflower seed is so good from other places, is that the average crop of the best heads of this vegetable obtained in those places is high. In Eastern Ontario, we have had three successive droughts and the vitality of the potatoes has been so lowered that it will take quite a while to bring them up. I agree with Mr. Raynor that we can keep on improving our potatoes if we stick to one variety. Our stock of potatoes will improve again. I have had one variety of potatoes at the farm which we have been growing for 19 years and which has not shown any depreciation at all except that which resulted temporarily from the severe drought. But a change of seed from time to time from the Maritime Provinces, or even from the cooler and moister parts of Ontario, would, I believe, be desirable, and it would be especially so if it could be obtained from a member of the Association who is breeding potatoes.

The Chairman.—I notice here an item entitled nomination and election of members of the Association. You will understand by the Constitution of the Association, that men who are engaged in the process of growing seed and have performed that work to the satisfaction of this Association for one year are eligible for election to membership by the Association at its annual meeting.

Moved by Mr. Davidson, seconded by Prof. Klinck, that the 30 applicants, whose names have been submitted by the Board, and who have become eligible for membership in the Association be duly elected.—Carried.

The Chairman.—We will now have a paper by Mr. George Michaud, Assistant Seed Analyst, Seed Branch, Ottawa, on 'Conditions which affect the vitality and vital energy of seed.'

(For Mr. Michaud's paper see page 63.)

The meeting adjourned at 6 p.m., to meet again at 8 p.m.

EVENING MEETING, 8 P.M., FEBRUARY 4, 1909.

The evening session of the Fifth Annual Meeting was called to order at 8 p.m., the President, Dr. Jas. W. Robertson, in the chair. The first item on the programme was the Presidential address.

(For this address see page 47.)

The President.—We are favoured and honoured to-night by the attendance of the Honourable the Minister of Agriculture, Hon. Sydney Fisher. It is a matter of much satisfaction to us that we are to have, in addition to other things he may find it agreeable to say, a statement from him about that great International Congress of

Agriculture which was held at Rome and of which he was, to our credit, one of the honoured officers. I have pleasure in asking Mr. Fisher to speak to us.

(For Mr. Fisher's address see page 52.)

The President.—I am sure you all join me in presenting to the Minister the warmest thanks for his presence to-night and for the statesmanlike speech he has made. We know that when he goes to Washington, while his modesty makes him say that he will learn a great deal, Canada will not be unfitly represented and that the other representatives will gain something from him. In both giving and getting, we wish him and his associates every success and, when he comes back, all merited recognition for the service rendered to Canada.

Our next number on the programme is an address by Mr. Peter H. Mackenzie, known to all of us as the gentleman who so successfully and efficiently acted as chairman of the Parliamentary Committee on Agriculture and Colonization. May I take this opportunity to express my appreciation of the excellent service rendered to Parliament and to Canada through the chairman of this committee, and also my recognition of his uniform courtesy to myself whenever I had occasion to come before the committee? May I also speak of my regard for the late secretary of that committee, Mr. J. H. MacLeod, who did a patient, excellent and fruitful labour in editing the reports of the committee? For the library of Macdonald College, we find it difficult to acquire books which give any sort of exact record of the progress in Canada of agriculture. I find nothing equal, in the range of material, to the reports of the House of Commons Committee on Agriculture and Colonization; and I offer anew my personal tribute of regard and appreciation to the work of the secretary who edited these reports. They help us in seeing the path before us and in finding our way to more successful practices.

I use this occasion to say that no one knows better than I do now, that most of the strictures passed upon those who are in the Civil Service are misfits and are but an expression of the lack of knowledge of those who speak them. Mr. J. H. Macleod, like hundreds of others in the Service, was a man who did his duty every day, and left behind him the results of honest faithful work of real value to the country. I am sure Mr. Fisher will join me in this tribute to the kindly, modest and good service of this late servant of the country.

(For Mr. Mackenzie's address see page 56.)

The President.—This completes the official programme for the evening, and I am sure you all join with me in an appreciation of the encouragement that has come from the two speakers of the evening, each of whom occupies a high official position in relation to agriculture in Canada.

I hope you will all become good multiplying plots, intellectually and socially, and that you will bear good harvests out of these gatherings. I am sure that if the evening could be made to yield us five hours of time instead of two and a half, you would like to have a discussion of these two addresses. I had thought that it might be convenient; but I am admonished that in Ottawa it is evidence of bad manners to keep late hours. I declare the session adjourned.

MORNING SESSION FRIDAY, FEBRUARY 5, 1909.

The meeting came to order at the call of the President, at 10.30 a.m.

The President.—I have personally to express regret at my inability to be here yesterday. The first item this morning is unfinished business. Under this heading we will consider the proposed amendment to the regulations of the Association concerning the registration of seed.

Moved by Mr. Raynor, seconded by Mr. Innes, that the proposed amendments be accepted for special consideration.—Carried.

Prof. Zavitz.—As nearly as I can learn the suggested amendments would not interfere with the work of the Association in any way. I do not think it would be wise to make any radical change in the system. The arrangement under consideration would simply be an enlargement of our regular work, and in connection with or in addition to securing the grain from the different experimental farms it seems to me it would open up a new channel of work for the members themselves. Many of the men who have been carrying on this work may wish to start with individual plants. If they start with individual plants and increase the progeny of the one which they choose it would provide an additional opportunity for the members of the Association and it would also bring the work of the experimental farms and the colleges into closer relations.

Dr. CHAS. SAUNDERS.—Supposing the quantity of seed sent out to one individual by an experiment station were not sufficient for sowing a quarter of an acre, would a member of the Association be allowed to propagate this seed himself for a year or two, without the grain losing the rank which it had when he received it? It seems to me that some provision should be made to cover such cases. At present it is not encouraging to the experiment stations to send their best seed to members who do not propagate it but merely use it as a basis for further selection. I think some mutual understanding would be advisable to bring about such recognition of the seed produced at the stations as would induce the man who receives it to propagate it carefully, with a view to having its progeny registered.

Senator PERLEY.—I should like to know how much of this hand-picked seed is required to sow a quarter of an acre.

The PRESIDENT.—About 35 pounds in the head.

This improved seed referred to by Dr. Saunders, would go into the hands of the man as registered seed. It would then be treated as required by the Association and no more seed would be selected than would be sufficient to sow an area of four times that of the plot from which the seed was taken. The section in which this regulation is found is followed by the modifying clause: 'The provisions of this section—at the discretion of the Executive Council—shall not apply to the selection of seed produced by an individual plant used as foundation stock or to the progeny of such seed in successive generations until the quantity of hand-selected seed has increased sufficiently to plant a hand-selected seed plot of one-quarter acre.' As soon as it has increased that much, the regulations of the Association apply.

Dr. C. SAUNDERS.—The experiment stations would of course have on hand enough seed to sow one-quarter acre before any of it would be distributed. Would such a condition as this lead to any difficulty in interpreting the regulations?

The PRESIDENT.—The proposed amendment has the following clause in it: "The successive progeny of an individual plant may—at the discretion of this Association —each be accepted in the records of this Association as hand-selected seed, until the quantity has increased sufficient to plant a hand-selected seed plot of one-quarter acre.' The phrase: 'At the discretion of the Association' would seem to cover the difficulty.

Senator PERLEY.—In this foundation stock would you consider single plants?

The PRESIDENT.—Yes. We grew last year on the research plots of St. Anne's, over 200,000 individual plants that were carefully studied with a view to selecting a number as foundation stock for improved strains.

Moved by Mr. Innes, seconded by Mr. Davidson, that the regulations regarding registration of seed be amended in the case of section 30, by adding clause B.

The PRESIDENT.—Would you be in favour of leaving to the discretion of the Association the matter of deciding whether or not seed may be entitled to registration even when there is not a sufficient quantity to sow the required area?

Mr. CLARK.—The Constitution as it now stands accepts the individual plant as the basis of improvement in the case of potatoees and corn. The proposed amendments contemplate allowing the smaller cereals the same privilege largely because of the work that is being done by cereal breeders and others who already recognize the individual as the basis of improvement. There are plenty of men in Canada who have had long training as members of the Association—some of them graduates of schools of Agriculture and Agricultural colleges—who are well equipped for making good use of this selected seed. By increasing the quantity, maintaining the purity and selling this seed, they could do an immense service to the country as well as to themselves.

Prof. ZAVITZ.—In order to carry out the proposed system of supplying seed from Guelph in sufficient quantity to sow ¼ acre, there would have to be a change made in our whole system as we have not the area for growing these larger quantities. I am unable to say off-hand whether that could be worked out or whether it would be advisable to do so.

Mr. MACOUN.—The same difficulty would arise at the Central Experimental Farm. It would require entire reorganization there. Under the present system this seed is sent out in small quantities of three pounds each.

Dr. C. SAUNDERS.—Most of our selected seed grain is transferred from Ottawa to one of the branch experimental farms, and is grown there for at least one season before being distributed. How would the proposed amendments operate in such cases?

Mr. CLARK.—I understand that a great many varieties which are originated here at Ottawa, by Dr. Saunders, are intended for use in the West; and it may be desirable to send them to Indian Head or Brandon in order that the quantity may be increased there. So long as this work is under the control or observation of the original operator, the case would be covered by the proposed clause.

Mr. SHUTT.—This is not a question that can be discussed intelligently by the rank and file. I believe that the Association, as a whole, would be willing to amend the Constitution as suggested, but I think it would be advisable to have the matter further considered by a special committee.

Moved by Prof. Zavitz, in amendment, and seconded by Mr. Macoun, that the matter of amending the Constitution be postponed for another year in order that the details may be worked out.

Dr. C. SAUNDERS.—May I be allowed to oppose this motion? I have a number of letters from members of this Association asking for specially selected seed. These letters are being held over to see what recognition this Association will give to this seed, as it seems unwise to send it to these members if the propagation of the grain is to be delayed by two or three years of further selection. I hope therefore that some decision will be reached by the Association at this meeting.

Moved in amendment to the amendment by T. G. Raynor, seconded by L. S. Klinck, that this matter be considered by a special committee during the present session. The amendment to the amendment prevailed.

The PRESIDENT.—On your authority, I appoint as a committee to deal with this question, the executive council plus Dr. Charles Saunders, W. T. Macoun and Mr. Geo. H. Clark.

The report of the nominating committee was next received. The first officer nominated was the President, Dr. Jas. W. Robertson, again receiving the nomination to this office for the ensuing year.

Moved by Mr. Innes, seconded by Mr. Raynor, that Dr. Robertson be re-elected President.—Carried.

The PRESIDENT.—I thank you for continuing me in office for one more year. Others might fill this office more acceptably and more conveniently, but for another year, I will do the best I can.

The committee further nominated the following ten men to form the first ten of the Board of Directors which are elected by the Association: Prof. C. A. Zavitz, Messrs. Thos. A. Peters, G. A. Gigault, Thos. H. Woolford, Jno. Bracken, W. L. Davidson, Hon. W. R. Motherwell, Thos. S. Waugh, J. O. Duke and Jno. Mooney.

Moved by Prof. Klinck, seconded by Mr. Wheaton, that these gentlemen be elected.—Carried.

I now have much pleasure in asking Prof. Harcourt to address the meeting on 'Observations on the bread-making qualities of the flour made from different varieties of Ontario fall wheat.'

(For Prof. Harcourt's paper see page 69.)

The PRESIDENT.—I have followed with keen interest this excellent paper, and I am sure we shall derive still more benefit in reading it and in examining the immense mass of information brought before us. I have pleasure in asking Prof. Shutt to open the discussion on this paper.

(For this discussion see page 75.)

The morning session adjourned at 1 p.m.

AFTERNOON SESSION, FRIDAY, FEBRUARY 5, 1909.

The meeting resumed at 2.30 p.m., February 5, the President in the Chair.

The PRESIDENT.—The committee, consisting of the Executive Council plus Dr. Chas. Saunders and Mr. Macoun, which was asked to specially consider the proposed amendments to the Constitution and report to the Association at the present session, begs to recommend that the regulations in regard to the registration of seed be amended as follows: 'That to section 30 there be added a clause designated as clause (b) and which reads as follows: 'The provisions of this section shall not apply to members who may select individual plants of merit, for use as their foundation stock. The progeny of any individual plant may, at the discretion of the Executive Council, be accepted in the records of this Association as hand-selected seed in each successive generation until the quantity has increased sufficient to plant a hand-selected seed plot of one-quarter acre.'

That to section 32, clause (b) be added as follows:—

'The provision of this section—at the discretion of the Executive Council—shall not apply to the selection of seed produced by an individual plant used as foundation stock or to the progeny of such seed in successive generations until the quantity of hand-selected seed has increased sufficient to plant a hand-selected seed plot of one-quarter acre.'

That an additional section designated as 32 A be added to the Constitution, as follows:—

'Any selected seed produced by a recognized expert attached to an Experiment Station may, at the discretion of the Executive Council, be accepted in the records of the Association and given a registration record not higher than hand-selected seed of the fifth year.'

Moved by Mr. Gigault, seconded by Prof. Zavitz, that these amendments be adopted. —Carried.

The PRESIDENT.—I will call upon Prof. Klinck, of Macdonald College, for an address on 'The improvement of Corn in Canada.'

(For Prof. Klinck's paper see page 76.)

The PRESIDENT.—Prof. Klinck said Leaming began to select his corn some 80 years ago, and as there is a good deal yet to learn about Leaming corn, I can give Prof. Klinck the assurance that for at least 80 years he can come to this meeting and discuss this subject without tiring us.

I will ask Mr. J. O. Duke to open the discussion on Prof. Klinck's address.

(For discussion on Prof. Klinck's address see page 80.)

The PRESIDENT.—The next topic is a paper by Dr. Charles E. Saunders, on 'The production of improved varieties of cereals.' Dr. Saunders is doing a most interesting and valuable work in this sphere of activity.

(For Dr. Saunders' paper and discussion thereon see page 81.)

The PRESIDENT.—We are indebted to Dr. Saunders for this presentation of his views on this most important subject, and are under obligation to him for what he has seen and interpreted. What one good honest man has seen cannot be contradicted by another good honest man. It must be supplementary, not contradictory. I think some of us see a very distinct line of labour for the experiment stations in originating improved strains, by which means the crops will be improved and increased.

Prof. ZAVITZ.—I would like to say something by way of correcting one or two things in the report of last year. (4th Annual Report.) On page 46, in the discussion of my paper on plant improvement, I am quoted as follows: 'In connection with our work we have handled thousands and thousands of plants and have selected many individual plants, but we have not obtained as good results as we did from the original stock.' The statement, as it stands, contradicts the results realized in Sweden by Nilsson and in this country by Dr. Saunders, myself and others. I would like an opportunity of correcting this statement for the next annual report.

The PRESIDENT.—I am sure we will hope that Prof. Zavitz will do the farming population of Canada the justice of making this matter clear. I have followed with interest for 20 odd years the work of the college and I would like to have everything in our report coincide as closely as possible with the actual work that has been done there.

(For this correction see article entitled 'The improvement of farm crops by the selection of individual plants,' by Prof. Zavitz, page 85.)

The PRESIDENT.—I will now call for the next paper, by Mr. MacVannel, on 'Our common barleys and the field open for their improvement in Canada.'

(For Mr. MacVannel's paper see page 86.)

The PRESIDENT.—There is a great deal to learn about barley. Certain soils that will not produce anything else, will give a fair crop of barley. I am glad our attention has been directed to this crop as well as to wheat.

We will now have the report of the Treasurer.

(For Treasurer's Report, see page 36).

The PRESIDENT.—You have heard this report which is certified to by the accountant and the other auditor. What shall we do with it? Moved by Mr. Wheaton, seconded by Mr. Davidson, that this report be accepted.—Carried.

The PRESIDENT.—We have a number of gentlemen who have favoured us from time to time with addresses and co-operated with us in other ways and it has been recommended that these be elected as honorary members of the Association. I find that some of the names on this list, like my own, are those of men who have long been connected with this work, and who have contributed to its advancement, but have not yet been made members of this Association. The names are as follows:—Messrs. F. W. Hodson; S. E. Briggs; Wm. Ewing, T. R. Garton, Winnipeg; Dr. Chas. E. Saunders; Jas. Murray, Superintendent of the Brandon Experimental Farm; F. T. Griffin, Land Commissioner, Winnipeg; G. C. Creelman, President of the O. A. C. Guelph; J. W. Gibson, Ottawa, who was identified with the school garden movement; Léon Gérin, who is doing so much for Agriculture in the French districts of Quebec, and who represented the Association last year at Sherbrooke; Mr. Peter McKenzie, who gave us a capital address last night; N. S. Archibald, B.S.A., Truro, N.S.; J. H. Hare, B.S.A., Whitby, Ont.; B. M. Winslow, B.S.A., Picton, Ont.; R. E. Mortimer, B.S.A., Collingwood, Ont.; F. C. Hart, B.S.A., Galt, Ont.; A. McKenney, B.S.A., Essex, Ont.; W. A. Munro, B.S.A., Morrisburg, Ont.; R. S. Hamer, B.S.A., Perth, Ont; Mr. McKenzie, B.S.A., Lindsay, Ont.; Geo. H. Shaw, C.N.R., Winnipeg, Man. I have pleasure in proposing that these names be added to the list of honorary and corresponding members.—Carried.

The next item on the program is an address on 'How plants feed,' by Prof. Lochhead, professor of biology at Macdonald College. I have very great pleasure in asking Prof. Lochhead to address us on this subject. I may say that to those of us who handle the soil and the seed and the crops, it is more than worth while to listen to a master of interpretation of the processes involved.

(For Prof. Lochhead's address and discussion thereon see page 91.)

The PRESIDENT.—I think it is Sir Henry Thompson who says that nearly all the ailments of human flesh are due to the fact that men and women do not feed themselves right. I think that is the general conclusion of physicians and mature men. If we would take this one lesson from plant life, that you never knew a plant to have gout or indigestion, you will realize that it is worth while to learn these simple lessons from our plants. One of the gravest questions of our present social life is the liquor question. Perhaps Prof. Lochhead will, on another occasion, give us an address with the proper moral deductions, on how plants drink. We might get in that matter fuller knowledge and understanding of the meanings of life and the possibilities for each of combining services with happiness and satisfaction to oneself and others. The more we get this into our consciousness, the more we shall go forward, not only as seed growers, but as citizens.

The last item on our program is an address by Mr. J. W. Gibson on 'The Seed Plot as an Educator.'

(For Mr. Gibson's paper see page 96.)

The PRESIDENT.—I am quite sure you will all agree with me that it was a good thing for us to have this address and this subject as the last. When one has enjoyed a good meal, generous and varied, it is delightful that the last dish should be one which leaves a good taste in your mouth in the morning. I think we can say that of the program and of the paper we have heard as the last number. I quite agree with Mr. Gibson and our friends, who have spoken to-day, that the ultimate aim of this Association is to have the seed life in the boy and girl developed, purified and strengthened, so that their life may be a little more beautiful. I thank Mr. Gibson for his address.

The report of the Resolutions Committee was presented by Mr. Wheaton, as follows:—

MR. CHAIRMAN AND GENTLEMEN,—Your Committee on Resolutions begs to report as follows:—

(1) *Resolved,* That the thanks of this Convention be tendered to the Canadian Pacific and the Canadian Northern Railways for special railway rates granted to officers of this Association last summer when visiting members in the West.

(2) *Resolved,* That the thanks of this Association be tendered to the Eastern Canadian Passengers' Association for special rates offered to delegates to this Convention.

(3) *Resolved,* That the thanks of this Association be tendered to Mr. F. T. Griffin, C.P.R., Winnipeg, and to the Wm. Ewing Seed Company, Montreal, for prizes donated for competition by members of this Asociation.

(4) *Resolved,* That this Convention places on record its appreciation of the continued assistance rendered the Association by the Department of Agriculture in granting funds for carrying on its work, in printing and distributing the annual report and in so arranging that officers of the Seed Branch could assist in the inspection of seed plots of members.

(5) Since we last met together, death has removed from our midst one of our most helpful and valued co-workers. In the late Dr. James Fletcher this Association had a wise councillor and an enthusiastic supporter of all that it stands for in the production of better seeds and in the improvement of the grain crops of the country thereby. His mastery of the subjects under his supervision and that rare enthusiasm which he brought to bear upon his work, makes his place in the public service very difficult to fill. We, therefore, desire to place on record our appreciation of his services to this Association and our deep sense of loss in his untimely demise and to extend to his widow and two daughters our heartfelt sympathy in their bereavement.

The report was adopted with applause.

The Convention was then declared closed to meet again at the call of the President.

PART II.—PAPERS AND ADDRESSES PRESENTED.

PRESIDENT'S ADDRESS.

(Dr. Jas. W. Robertson, Macdonald College, Que.)

Gentlemen,—On this occasion, I venture to be the spokesman of the Executive and the members, to explain, on their behalf, to others who do not know what this association is and what it has done, something of the origin, the objects and the methods of the Canadian Seed Growers' Association. We may thus spread a knowledge of what the Association is doing, that the application of its methods may be extended more widely and made more effective for beneficial service on the farms of Canada.

The use of seed specially selected from good crops is a very ancient practice. We claim nothing novel in what we seek to apply to the crops of Canada, by means of selection of seed. There is the authority of the accumulations of the experience of farmers for centuries in support of the practice of selecting seed from vigorous, productive plants for next year's crop. We grope, and we fail, when we begin to offer explanations as to biological principles that underlie improvement in plants. Our explanations are often quite faulty and always incomplete; but the observable tangible results in the harvests are a perennial proof that the practice of selecting seed from vigorous, productive plants is beneficial and profitable. Let me cite an example or two to make this clear, and to get you, and others who may read what I have said, into closer sympathy with the Canadian Seed Growers' Association. On the farms of old Scotland, which I know reasonably well, it was a commen practice to build a stack from that part of the crop which was most vigorous and most productive and of the highest quality. This grain was kept by itself for seed, after being well winnowed and cleaned. That practice was not invented in Scotland; it has been the practice ever since men applied their intelligence and their insight to farming; and that practice our latest experiences and observations fully endorse.

I thought I would venture to read one brief extract to-night, so that no one would suppose that the Canadian Seed Growers' Association or its President claims novelty for the practices they advocate. I picked off my shelves a translation of an old book, and this is what I found in it:—

'I have, indeed, seen many sowers artificially prepare their seeds, and steep them first in saltpetre and black lees of oil, that the produce might be larger in the fallacious pods. And though, being hastened, they were soaked over a slow fire, selected long, and proved with much labour, yet have I seen them degenerate, unless human industry with the hand culled out the largest every year.' That is a reasonably clear definition of hand-selected seed, is it not? 'Thus all things, by destiny, hasten to decay, and, gliding away, insensibly are driven backward; not otherwise than he who rows his skiff with much ado against the stream, if by chance he slackens his arms, and the tide hurries him headlong down the river.' That is from Virgil and was written before Christ was born. The hand-selection of seed is a reasonably ancient practice.

Let me cite another event that had to do with the birth of this Association. Up the Gatineau river, some years ago, lived a family by the name of Meldrum. My father--in-law, whose reading was wide and whose insight was keen and deep, knew them well. Mr. Meldrum was a good farmer and had several daughters. He had his daughters go into the wheat fields and gather the largest and plumpest ears into their laps and aprons. This process of selection was continued for years, until finally Meldrum's wheat was known all over the country and captured the prize at the great Paris exhibition, when we first began to exhibit our grains abroad. That practice was profitable to Meldrum, was helpful to his neighbours, and was creditable to the country, for it furnished us our first international reputation in wheat.

In looking over some documents, I came to a period, only some ten years ago, when, having learned of this Meldrum management in evolving the fine wheat of that name, I wondered whether the boys and girls would pick out from their fathers' crops a number of large heads. I got the consent of the Minister of Agriculture to have the privilege of the post office extended, and invited the boys and girls to compete, offering $100 in prizes. I had a large and generous response and distributed $100 in prize money. That led to the proposal to offer prizes on a larger scale, to do more effective work than the little beginning, if left unsupported, was likely to accomplish.

It would be unkind to detain you with details that are to some of you common knowledge. I can recall sitting in my study on Wilbrod street, toasting my feet before the fire, before Christmas, talking over these things and thinking of them with some care, with the result that I decided to go to Montreal the next day and ask Sir William Macdonald for $10,000, which was a reasonable and modest application for one Scotchman to make of another. I went and explained to Sir William that the object would be to teach the boys and girls to study this principle of selection and to practice it on their own farms. Sir William cheerfully gave the money, the price of two farms, to make an impression on the minds and practices of the farmers. In January it was decided to announce through the press that this seed grain competition would begin in the summer and that prizes would be given to the boys and girls having the best results—$25 for the first prize in each province for the boy or girl who got the best heads, weight and number counted. The heads were to be taken from a plot of grain not more than one acre in extent; they were to pick from the crop of that acre enough heads of oats or wheat to sow a quarter acre the following year, and then to do the same the following summer; they were to pick the biggest and best heads for seed to sow the quarter acre. The boy or girl in the main competition in each province who showed the greatest increase in the yield of his hundred heads and in the yield of the plot between the harvest of 1900 and 1902 was to get $100, the next $75, and so on down. Over 1,500 entries were made; and so it was no small thing. No fewer than 450 carried the competition right through satisfactorily for three years. That was a pretty good thing. Even if they failed to obtain a prize the first year, they carried it right through in the following years. The harvest is now even greater than those days promised. Some of the increase was doubtless due to the heightened skill and deepened knowledge of the competitors. They were able to pick better, but that was not the cause of the increase as a whole, because as a whole, in all these plots from 1900 to 1902, there was an increase in the yield per acre of 40 per cent in the case of spring wheat, of 36 per cent in the case of oats, the former also being 28 per cent and the latter 27 per cent heavier per 100 heads of grain, than the unselected grain. That was not due to fortuitously favourable seasons, it was a progressive increase. It is an indication of the probable profit to the persons who follow this practice—an indication of direct and immediate profit to the grower himself. While the individual grower gains a profit, his neighbour reaps much benefit and service of a high order.

In 1900, soon after the announcement was made, I looked around for a competent man to manage the details and give effect to the plans for carrying out the competition. I found a man who had in him every promise of being efficient and trustworthy. His name was George H. Clark. He was engaged at a salary of $800—the Department paid $800 a year and Sir William Macdonald paid $10,000. There were three years of fine work done by Mr. Clark. He was the first man who rode a bicycle to visit farms in this sort of work. It was then common to hire a livery team at high prices; but the Department of Agriculture could not stand that expense. Mr. Clark rode his bicycle in those first years of the seed competition, and the bicycle has now become a common means of travel by experts in this work. He got into personal communication with the boys and girls. I have been looking over some letters I would have been proud to have written—letters not only of encouragement, but breathing the spirit that is inspiring to the boy or girl who gets the letter, and having peculiar power to breathe into human clay the breath of life and make the clay more spiritual. These letters were composed in the main by Mr. Clark and signed by James W. Robertson, because my name was better known.

At the end of three years prizes were paid to the amount of $10,842. That was the total amount paid in prizes. That was the direct reward to the boys and girls. I want to show you something of the service to agriculture that came from that honest endeavour to this good thing and do it well. There was just one man working among the farmers in this particular field of the selection of vigorous seed.—just one man, Mr. George H. Clark. The total vote for that service then was included in the larger sum for the Commissioner's Branch and came to $800 for salary and half as much more for expenses. In looking over the estimates for last year, I find that the vote or votes for the Seed Commissioner's Branch (Mr. George H. Clark is now Seed Commissioner), were $65,000. You see how the service by the Government has grown and how the advantage to the people has increased. The money does not measure the work, because out of that has come certain other organizations and many other kinds of service along allied lines. There was the good-seed train, which was a mighty factor in impressing upon the farmers the profits and advantages of good seed and the loss from weeds. Then there were the seed fairs. I notice the report of one being held in Calgary, Alta., by the Provincial Government, in which they say they have exhibited the heaviest wheat yet discovered—68½ pounds per bushel. It was highly creditable and one of the other children of this movement. Then there are the field competitions for standing field crops; and the Seed Control Act; and last to be mentioned but not the least, there is this Canadian Seed Growers' Association, which also came out of that. Now for a very brief mention of what has been done by this Association, considering its ancestry and responsibility. In March, 1903 (that was just after the final prizes were paid), a good many parents of those competitors and some of the competitors themselves expressed a willingness to become an Association, to keep up this practice they had found so valuable. They were formed, at their own desire, into what was known for a year as the Macdonald-Robertson Seed Growers' Association. It was a bulky name and after a year it was thought best, by all of us, that it should become the Canadian Seed Growers' Association. So in June, 1904, it became the Canadian Seed Growers' Association. Mr. Clark was its secretary-treasurer, the Department of Agriculture having at that time no objection to its officers being officers of volunteer Associations like this. The object of the Association has been of the same nature from the beginning. To quote two lines from the preamble. 'The object of this Association is to encourage the general use of improved seed with a view of increasing the yield and quality of the field crops of Canada.'

The members of the Association carry on their work in accordance with the directions and rules contained in the constitution, by-laws and explanations.

I was asked twice after the last annual meeting what the Association members did. I thought I had explained that in my address, but evidently I had not. I thought this time I would make it clear. I hope that the members of parliament will understand, so that they may furnish the sinews of war, for the department requires that sort of support. Each member of the Association is required to carry on the work of selecting seed by hand from a plot, choosing in his selection the heads nearest the type which he has in mind and toward which he works, and always from specially vigorous and productive plants. He carries on the work of hand-selection, which has been carefully and fully described by Virgil. I am sorry I did not have that in mind earlier; as it could have been transposed into the constitution. Not only does he do that, but it is required that he shall have his seed plot prepared in a particular way to carry the crop. Any kind of preparation is not adequate. It must be after a certain crop, it must be in rotation; it must be in its right place, which is a very important thing to remember. Thereby you get a very great effect on the vigour. I believe more things than I can explain, and I am willing to accept some things on the authority of other men who have established their right to have confidence placed in their judgment. I once walked over the Rothamsted Experimental Farm in England, which has perhaps led us all in our improvements in agriculture. In discussing matters with Sir John B. Lawes, he showed me two plots side by side. In one of them the land had been manured annually for 36 years and the other had received no manure for 36 years.

Thirty-six bushels of wheat per acre was the average yield of the first and 13 bushels per acre of the second, 'Which is about the average yield per acre of your virgin continent, according to the reports of your Departments,' as Sir John put it in his genial, jesting way. While I observed with much interest the wonderful difference in the yield between those two plots, which were planted with the same variety, I asked what the probable result would be if one sowed the seed from this productive grain and from the unproductive grain on equally good land.

He said: 'I think you would find the effect of this productive crop in the harvests for three years.' This was his judgment. There was no proof, but I put much dependence in the judgment of such a man. The hand-selected seed plot *as a plot* is worth while as well as is the process of selecting seed by hand. That is the inclusion by selection of what is desirable. After the grain is threshed, there is the exclusion of what is undesirable, which is also important. In the exclusion of the small and shrunken seeds and the inclusion of the plump and well-ripened seeds, in the inclusion of the best seeds and the exclusion of the poor seeds, I think we have at least two good points which the common man can understand and put into practice. Whether there are other ways to gain the end, I cannot say, but perhaps there is no other way so simple which will appeal so quickly to the understanding of the farmer.

When the work is done, there is also the value to the man himself, and to the locality of the records kept. The results are recorded at the headquarters of the Association, and that record of results has also a stimulating and a rewarding value to the seed grower.

This practice which I have been describing, and which I have been claiming as good practice from away back, with the results in evidence in the harvests and grain bins, is also based on sound principles when you come to think of the fundamentals in the production of crops. The success with which any plant obtains its food from the soil and the air, and thereby makes increase, either in large measure or in little degree, depends perhaps to the largest extent upon its opportunities. Every sort of life is bounded, in regard to its achievements, in a measure, by its opportunities; and the plant more than other things, because it cannot get up and go away; it has to stay where it is put. To achieve great things it must have proper food for growth, a suitable climate and sufficient water for circulation—these are its opportunities. Then its success depends, on the other hand, upon the power of the individual plant to make a good use of those opportunities. That is not a new law; it is a law that runs through all life, limited in measure by the restrictions or wide encouragements of opportunities, and then limited again by the power of the life to make the most of them, and to appropriate and use them. In support of that position, let me cite the improvement in the sugar beet. By the selection of the mother plant, by selecting for seed all that has a high percentage of sugar in the sap, by doing that continuously, the growers have increased the percentage of available sugar from 8 per cent or 9 per cent to 14 per cent and over in some cases. That is a direct increase in the quantity and quality of the sap per acre by selection of the mother of the seed from which the crop came. Then there is the Sea Island cotton, in which the fibre has been improved by the process of selection. By the selection of the mother plants for seed, the improvement of the cotton fibre in length and quality has been very notable.

What has been done by our own people in this way? They say they have found these things true in their own practice. Joseph Perron, from Les Eboulements, Que., writes:—

'I am pleased to tell you that since I have been selecting my grain I have increased the yield of my crops 30 per cent in four years only.'

Mr. Gies writes from the province of Ontario:—

'I find that no matter how well my soil is fertilized and cultivated, the quantity will be deficient and the quality poor unless high-class seed is used. For the last five years I have paid special attention to the selection of wheat. I have found my extra labour is well repaid in the increased yield and quality of the crop.'

One of the western men writes:—

'I am well satisfied with the results of my work and see a marked improvement in the alfalfa with which I am operating. I have not had much demand for the seed, but feel I am well repaid by the improvement in the crop.'

Representatives of the Seed Division know these statements are representative of statements from all over the Dominion.

It seems that we have a particular quality of excellence in plants like wheat, oats and barley or they would not have persisted in their superiority over so many other plants for so long. They are the very kings in plant life—what shall I call them? how shall I represent them?—the Darwins, the Tennysons, if you will, or the Oliver Cromwells, or the Florence Nightingales, or the Lincolns, or the Lord Kelvins, or Lord Listers, or the Pasteurs, or the Shakespeares, in the plant world, are the wheat and the oats and the barley. Myriads of the common level of us, and just a few peaks, here and there, in the plant world and the other worlds. That sort of life seems to me to have immense unrevealed possibilities. Abundance of latent power you have in wheat, with ever-pressing impulses, pushing this way and that way and looking for a chance to go forward and be better and larger and more vigorous than common plants. They have proven their quality by those centuries of superiority to common things. There are plenty of mutations and only a few Burbanks, just a few Saunders in the whole world, who have that discerning eye and that grasp of things which enable them to catch the mutation and make it of wide service. It is a great thing for a man to have a hand in letting this wheat and oats and barley have a free course and be glorified on the fields of Canada. I have put two men we know—Dr. Charles E. Saunders and Prof. C. A. Zavitz—on the list, and each of them has done more work for Canada than the more showy work of Burbank that has been spoken of.

May I support this question for a moment by telling of what the growers who have been asking questions of these crops all these years have heard and seen the crops answer them. By patient and constant inquiry made by our secretary two years ago, 88 per cent of those who reported, after having been asked to make careful comparisons, said they found an improvement in the size, plumpness and quality of the kernels; 83 per cent said they could observe good results in keeping strains pure; 73 per cent said the strains were becoming more adapted to local conditions; 64 per cent said selected strains matured more evenly; 47 per cent said selection had rendered strains more resistant to rust and smut. These are fine answers of the crops to our questions. They all report that there was an increased productiveness in yield from selected seed. May I mention some of the general results which may be expected on the wider fields of national agriculture. In one of these excellent Census and Statistics Monthly reports that have come out recently—and I have to congratulate the Honourable Minister of Agriculture on giving the farmers this valuable and usable report—in one of these reports I find condensed in a paragraph what helps me to understand the situation better, and gives a concept of the country as a whole. It is worth while to have a sight of the country as a whole that is within the power of your intellect to grasp. I do not suppose any of us knows how big a farm 27,500,000 acres would be. That is the acreage of 16 big field crops of Canada last year. The crop was valued at $432,000,000. That is a good deal of money. That represents wealth called out of chaos, so far as human use is concerned, called out of chaos into humanized, usable form. Canadians called this wealth into existence, in humanized form, real wealth for the people, in the harvests of last year. The grain crops, leaving out roots and hay, had a value of $245,939,000, the main value of which came from wheat, oats and barley. The acreage of wheat, oats and barley last year called for about 28,000,000 bushels of seed. You sometimes hear a farmer say: 'Oh, I wouldn't pay 25 cents a bushel more for the best selected seed I ever saw.' If you take that 28,000,000 bushels of seed and put 50 cents a bushel to it, that would be $14,000,000, if a man had to buy it for that much above the market price for seed. But if you take the actual results that were got on those 450 plots all over Canada—not by trained experimenters but by farmers' boys and girls

—from using good seed, and apply the rate of gain, they got, to these 16,000,000 acres of wheat, oats and barley, the increased yield in last year's crop would have been some 165,000,000 bushels. That is four times more than the whole volume of grain handled through the port of Montreal. It would fill 1,300 miles of railways and load 1,000 of the usual large size ocean steamers.

In Montreal they are fond of boasting of the Montreal Harbour and the rest of it, being the great channel out of which flow our products and through which our goods come in. But the whole handling of grain was less than 40,000,000 bushels, in a season including flour and meal. To make that seem more clear and matter-of-fact to you, let me cite something bearing on the province in which I live now, to show that this is no chimerical thing, but a thing we are about to realize upon. In Quebec last year, the value of the 16 crops grown was a little over $80,000,000. The six main crops made up $73,000,000. The Macdonald College Farm has been in operation only four years and therefore has not come to its full capacity for productiveness. We had a climate like the rest of Quebec. We did not put on much extra labour and the land is not nearly so productive as it will be after a while. If the crops in the province on the average had yielded at the rate of the crops on the Macdonald College Farm, instead of the farmers getting from those six crops $73,000,000, they would have gotten over $147,000,000.

I hope to live long enough to see the farmers of Quebec reap from their fields as large crops as the average last year at Macdonald College. Then Macdonald College must carry its average forward. It will be up to Klinck and Zavitz and Saunders to keep the crops on their plots ahead, to make a standard for us on the farm to catch up to. I think that is within the possibility of farming and it is part of the duty and privilege of this Association to help to bring this about. There is no good reason why we should not have much larger and better yields, why we should not obtain that reward which the earth always gives when a man applies to it intelligent labour and energy.

I took the opportunity to-night to restate the history, the position and the objects of this Canadian Seed Growers' Association, in order that at the beginning of the new parliament the men who come here may see and know something of the work of the past and the possibilities of the present. We should be up and doing if we are to be true to our obligations as well as to our privileges. It takes a good while for some ideas to come to their fulfillment, but an association like this helps to bring things to the harvest. I hope that before long every country will have at least one seed farm and that it may become an illustration farm for the county, not only in the production of seed, but in the right rotation of crops, and their proper protection against diseases, weeds and insects. Seed rightly selected on land properly prepared, proper rotation of crops and adequate protection; when these things are done, a great gain will not only be made in the harvest fields but in the ability of the men and the women and the boys and the girls who have benefited by this achievement, this new mastery over nature.

ADDRESS BY THE HON. SYDNEY FISHER, MINISTER OF AGRICULTURE, OTTAWA.

Mr. President and Gentlemen,—I must apologize with the very first word for anything in the nature of an address which I may give here this evening. I have been much occupied during the last few weeks and have not been able to give attention to the work of the Association at all commensurate with its importance. Let me congratulate you, Mr. President and gentlemen, on the progress of this work. Nobody appreciates or values its importance more than I do. I believe it to be one of the very most important works in the interests of that great business of Canada,—agriculture—which is going on to-day. The figures which you, sir, have cited here to-night are striking enough, startling enough, to arouse the attention of the whole people, if they can only be brought before them. I trust there will be a full report of what you have said, and that the report will be distributed so that the agricultural world of Canada will study and learn by it.

We are indeed in Canada shiftless farmers. We boast ourselves of being a great agricultural country, and to-day, not only the continent of America, but the world at large, is recognizing us as such; and when I go about and see what is said about our agriculture, and when I come home and look at the fields and look at the statistics, I am almost ashamed at the reputation we have in the world at large, because we ought to do so much more than we are doing. Still, with all that, agriculture, is the mainstay of this country. Without it, Canada would be small indeed. We say that Canada is rich and prosperous, but it is beyond the dreams of our most enthusiastic people, what Canada could be and would be if the advice which is given by this Association were taken. Under these circumstances, I value highly your work, and although at the present time the full value of that work is not apparent, I appreciate and understand that it is insidiously and silently improving things and helping on the conditions of our country. I have learned, in a long life of public work, the lessons of patience. I have frequently seen, after years of apparently fruitless effort, suddenly, sometimes very suddenly, a great change for the better and an immense leap forward, which is gratifying and which is the just and fair reward of those who are doing public spirited work, such as your Association is doing.

I know you have not said a word too much of the earnest, self-sacrificing work of the scientists who are teaching the farmers of Canada, who are labouring in the interests of the farmers of Canada, and making scientific knowledge their main end. The names you have mentioned are some of the leaders. There are other men who are following in the path of these leaders, and as time goes on I trust their work will be appreciated and that they will receive the credit which is their due. I feel to, sometimes, that none of us are doing our whole duty to the agriculture of Canada.

You have expressed a wish that in a short time there may be a farm, a seed-growing establishment, in every county of the Dominion, and that in every county in the Dominion there should be an illustration of what the use of improved seed would mean to the farmers of Canada. I feel myself that example and illustration are perhaps the very strongest lever to use in the teaching of agriculture to farmers I have no hesitation at all in saying that there ought to be in every part of the country an example and a model, which the farmer might look to near his own doors, that he might use it all the time. It is, however, a big undertaking, to organize it and to carry it out, even if the money were available. We all of us, and the farmers perhaps more than any one else, know better than we practice. I sometimes hear farmers telling their neighbours what they ought to do, and in their own homes and on their own farms they themselves are neglecting what they preach. This is common all over the country, and I fear the farmers are just as great sinners as any one else.

I should like to lay before this Association, something of the aims and objects of the International Agricultural Institute at Rome, a meeting of which I attended last November.

Let me first say a word regarding its history: The idea originated with an enthusiastic American, a certain Mr. David Lubin, of San Francisco, a gentleman engaged in commercial life, but who has far-reaching interests and a love of investigation and study; a man who has attained to large means, and who is therefore able to travel, observe and study. He noted the fact, and I think we may all accept it as a fact, that to-day in the production, distribution and commerce of the products of the world there is a great deal of waste, and that the final price of food to the consuming population is larger than their is any need for. His first idea was to counteract what I may call the market manipulation of the food necessities of the world. However, in the course of his study and work, he went farther than this and came to the conclusion that international co-operation might be very largely utilized to give accurate and full statistical information of crop production and the movement of crops, and to collect and distribute all the information which was available in the different countries in regard to agricultural experiments, investigation and methods of production. With this in view, he discussed these matters with a number of eminent men in Europe, among whom was one who knew His Majesty the King of Italy to be a monarch of wide sympathies and who was interested in his own people and in the community at large; a man who not only from his high position in the world had responsibilities, but one who felt the full measure of those responsibilities and did not allow even the boundaries of his own kingdom to measure them. Mr. Lubin was fortunate enough to be presented to the king. His Majesty felt that he must discuss with others of his own people these problems and see whether something could be worked out for their solution. This resulted in an invitation, sent out by the king, to all the great nations, inviting representatives to a conference in Rome.

That conference took place in 1905. Most of the delegates went there with very hazy ideas of what they were called for or what they would be able to do. Great Britain was represented by Lord Minto, our former Governor General, Lord Jersey, who was chairman of the first intercolonial conference held in Ottawa in 1894, and Sir Thomas Elliott, who is the permanent head of the Agricultural Department in Great Britain. That conference resulted in the sketching out of a scheme of international co-operation. The scheme, however, had to be laid before the various governments for their concurrence. This took time, and it was not until 1907 that all the replies were received from some 30 odd countries, accepting the proposition and announcing their desire to adhere to the institute and help on the work. In the course of this time, Great Britain, adhering to it herself, asked that an invitation be sent to her self-governing colonies to take part, and Canada received an invitation in 1907. We discussed the matter, and, feeling that Canada's agriculture was a most important element in our social system and that we were an important factor in the agriculture of the world, I recommended to my colleagues that we join the institute, and we did so. In the spring of 1908 a meeting of the select committee was called in Rome, to perfect the organization, and we were invited to send a delegate. Several circumstances conspired to make me select Dr. Rutherford, the head of the Live Stock Branch, who, as you all know, is well acquainted with agriculture in the Dominion. The language of the institute has always been French, and it was necessary, as well as advisable, to send a gentleman who knew that language. Dr. Rutherford was fortunately well acquainted with the language and could understand it and take part in the discussions. That committee perfected the organization, laid out a complete scheme, designated a staff of workers who would be able to do the work as laid out. That scheme was to be laid before a general assembly of the nations, which was called for November last in Rome.

It was to that meeting, on behalf of Canada, that I went, with some doubt and hesitation. The information I had been able to receive did not give me a clear idea of what was to be done, nor what benefit it would be to Canada and Canadian agriculture. Still I felt there were possibilities of great good and I wanted to satisfy myself, by a visit there, of the real value of the institute. When we assembled in Rome the scheme was laid before us, and we soon recognized in it a scheme presenting the greatest possibilities and one which was founded on an elaborate and well considered basis. In short, the scheme is this: To collect from all countries prompt, accurate and official information and statistics, and to bring those statistics all to a common basis, so that they may be properly compared and studied, and so that the full information will be in a form which may be studied by every country. That this full and accurate information, thus compiled, should be distributed to all countries and governments, and be available to anybody who applies for it. Full reports and information should be delivered at the headquarters of the institute in Rome, of all agricultural investigations and experiments, regarding methods, crops, climates and conditions. This information, when compiled, tabulated and put into convenient form, should be translated into the French language and made available to all the nations for their guidance and information.

I have no doubt whatever, that both these objects are of vast importance to Canada and that she will in the near future reap a great advantage from being a member of this institute, apart altogether from that which comes from the sense of national responsibility which we ought to consider and owing to which I think, we should bear our share of the burdens imposed by the great movements making for the benefit improvement and progress of mankind.

The institute is to be maintained in two ways. His Majesty the King of Italy has not only given his august patronage, but out of his own private fortune and apart altogether from his revenue as king, he has endowed it with an agricultural estate which has a revenue of $60,000 a year. He has handed over that estate to the institute, and its revenues go to the maintenance of the institute. The first three years' revenues (and it commenced when the institute was first talked of) were devoted to the home of the institute in Rome, a large well-built establishment, where the work can be carried on. In addition to this, each country is expected to contribute its quota. I do not remember what Canada's will be, but I think it is in the neighbourhood of $4,000 a year. Besides this outlay, there will be some little expense for us in having in Rome or sending to Rome a representative who will take part in the management of the institute.

I may say, as a matter of congratulation to Canada, in the recognition that came to her when the general assembly of the nations made its choice of chief officers of the institute, that the Minister of Foreign Affairs of Italy was chosen as President and the representative of Canada was chosen as first vice-president, on the motion of the Ambassador of Germany, seconded by the Ambassador of the United States. In the organization of the institute there is a permanent committee on which we have a member, the Hon. Arthur Boyer, of Montreal. The permanent committee is divided into three sub-committees, the President and the Vice-President of the permanent committee, with the chairmen of the three sub-committees, forming a small executive of five who have the absolute management of the institute under their control. Our representative, Hon. Arthur Boyer, was chosen chairman of one of the committees and is therefore one of the five who have the management and control of the whole. I think it is a matter of fair congratulation that representatives of our young, growing and ambitious country, in an organization comprising practically all the nations of the world,—the great nations of Europe, the great American Union to the south of us, and our sister colonies of India, Australia, New Zealand and South Africa,—have been chosen practically as the main representatives of the English-speaking part of this organization.

I need not say that it was intensely gratifying to me to meet there men occupying the highest positions among the great nations of the world, all there working faithfully, patiently and intensely in the interests of agriculture. It gives me a greater impression than I ever had before of the extreme importance of our business of agriculture in the economic and social conditions of the world. The ambassadors of the great powers of Germany, France, the United States, England, Austria, Hungary, and all the other great nations, were there as the representatives of their governments, and joined with them were agricultural experts and men who are the great agricultural magnates of these countries. One of the executive, the chairman of one of the sub-committees, is a great Hungarian land-owner, farming thousands of acres of land, with many thousands of live stock on his farm and looking after it himself personally and supervising it. You may be surprised a little at the numbers I have given you. It is no uncommon thing in the Old World to find such intensive farming, even on the scale of those acres; the number of live stock kept is greater than the wildest dreams our farmers would ever think of. It is one of the things which shows, as I have said, that we are shiftless farmers. There is no better object lesson than to travel through the cultivated fields of Italy, Switzerland, France, Belgium, as well as England and Scotland, to bring home to us the benefits of applying intelligent methods to the land. The figures of Dr. Robertson are only half the story. We can easily, in this country, quadruple and quintuple the products of our fields without adding a single acre to the area. We can, on the present cultivated area, easily support from 30,000,000 to 35,000,000 people instead of the few we have at present. I have recently been invited to take part in a conference which the President of the United States has called for the purpose of discussing the conservation of our natural resources. It is an important subject, a vast subject, for the agriculture of the United States and Canada to deal with. It is important because it aims to provide against the future before the necessities arise demanding that such work be undertaken. At the present time we are extremely wasteful of our natural resources and in some respects and in some places we have already done irreparable injury. There is still, however, an enormous field within our Dominion of unimpaired natural resources and it is our duty to see to it that they are no longer wasted. I am glad, therefore, that Canada is taking part in this conference, and I trust that as an outcome we shall be able to bring back from Washington, hints or suggestions which may be acted upon to prevent further waste, so that future generations may bless, and not curse us.

ADDRESS BY MR. PETER H. McKENZIE, EX-CHAIRMAN, STANDING COMMITTEE ON AGRICULTURE AND COLONIZATION.

Mr. President and Gentleman,—The objects of the Canadian Seed Growers' Association, as I understand them, are to increase the yield and improve the quality of the field crops of Canada. I believe the principal incentive on the part of the President and Directors of the Association is simply a wholesome desire to render a useful service to that portion of the people of Canada who make their living primarily from the cultivation of the land. They can hope to receive no other reward than a meed of praise in years to come and the satisfaction of observing a steady progress in Canadian Agriculture and agricultural methods.

Canada cannot have too many of such organizations. The material support which such organizations are receiving from our federal and provincial governments grows out of far sighted policies that are instituted and maintained by ministerial authorities who have to do with the agriculture of our country. That the Canadian Seed Growers' Association has already been able to lay the foundation for an exceedingly useful and far reaching service to the people of Canada is due in no small measure to the material support given it by the Hon. Sydney A. Fisher. As Minister of Agriculture he clearly understood the purpose of this organization when it was first proposed by Dr. James W. Robertson, then Commissioner of Agriculture and Dairying.

Educational work was started by the Department of Agriculture eight years ago, with a view to encouraging the application in Canada of scientific principles of plant improvement through the selection of seed. Sir William C. Macdonald, of Montreal, provided $10,000 as prizes to school children who would undertake the work under the guidance of their parents, of operating a hand-selected seed plot consisting of not less than one-quarter of an acre. This work was educational in effect and demonstrated to a large number of farmers, scattered all over Canada, the benefits that accrue from a proper system of seed selection. The Macdonald Seed-Grain Competition led up to the organization, by the Department of Agriculture, of the Canadian Seed Growers' Association.

The extent to which this Association may be able to render useful service to the farmers of Canada in years to come may be imagined from a consideration of the areas now under field crops—an area almost if not quite, 27,000,000 acres.

It is difficult indeed to fully appreciate the total amount of seed required each year to provide crops for such a large area. No one will dispute that farmers are more careful about the kinds and quality of the seed they use than they were ten years ago, but few of our farmers stop to realize what factors and forces have brought about these additional precautions on their part. Although the land in the western provinces is on an average less fertile than it was many years ago, yet the average yields per acre have not decreased proportionately. In most of the provinces, in fact, the yields have increased, which fact may justly be attributed to better cultivation and to the use of better and more productive seed. There is still room, however, for a vast improvement. In our eastern provinces, the average yield per acre of oats is only about 30 bushels. It would seem to be entirely practicable by better cultivation and the use of better seed of the best varieties, to almost double that average yield. If the grain crops alone for all Canada could be increased by two bushels per acre, as they might through the use of good seed of the best varieties, it would mean an increase of more than 30,000,000 bushels of grain per year. That is a goal worthy of the best efforts of this Association.

The work of the Association has not yet become extended so as to include to any extent the supply of seeds of our grasses, clovers and forage crops, but it seems to me that as soon as a favourable opportunity is presented, there will be found much need for the attention of the Association to this matter. Fully 97 per cent of our grasses and clovers in eastern Canada consists of timothy, alsike, red clover, and a little alfalfa. Comparatively few of our farmers are familiar with any other kind of grass than timothy, and, although that is an excellent kind for relatively moist lands, there are, we are told, several other kinds that are immensely better for large areas, particularly uplands. It seems to me that there is much need and an abundant opportunity for the members of this Association who are specialists in seed growing to improve, make pure by selection and produce seed in quantity for commerce of early and late red clovers, alsike, alfalfa and all of the various kinds of grasses that may be suitable for production in Canada under the different conditions of climate and soil.

Potatoes is another crop that can be immensely improved. The average yield per acre of potatoes for all eastern Canada is considerably less than 150 bushels. Our potato crop has been very unsatisfactory for several years. It would seem that we are in need of more vigorous types that will be better able to resist the ravages of fungous diseases. With potatoes and corn—two important farm crops that are, to some extent, handled by hand in the process of harvesting—it is considered practicable to base the selection upon the individual plant.

The corn crop is also an important one especially in the dairy districts, where it is grown for ensilage. These districts have in the past relied for their supplies of seed corn on the seed merchants, who bring it in from southwestern Ontario and the United States, where it is grown quite largely as a grain crop. By proper selection of seed corn we have reason to expect that in time the areas devoted to corn growing will be extended quite as far north as the districts where dairying is carried on to any extent.

The question of the supply of seed for our field root crops has long been a difficult one for Canadian farmers. We have not yet become accustomed to growing our own seed for these crops, partly perhaps because we do not know how to grow them, but more largely because they can be grown cheaper in Europe, where cheap labour is available. Some of our farmers who have come to us in recent years from Europe prefer to grow their own seed of turnips, mangels and carrots, and they have no difficulty whatever in so doing. They think that they get better results, in a better and more uniform crop, from the seeds which they have grown and selected themselves. If the growing of turnip, mangel, carrot and other field root and garden seeds in Canada, combined with such improvement as may be effected by proper selection, will help us to raise larger crops of better quality, then the production of field root seeds in Canada should be encouraged, even though the cost of the home-grown seeds may be quite double that of the imported article. I am of the opinion that the Experimental Stations should do more by way experimenting in the growing of these seeds.

I have learned from reading the views of speakers at former meetings of this Association that some are of the opinion that members of the Seed Growers' Association should select their foundation stock from one individual plant which has proven after thorough test to be superior to all others in yield and quality. I am inclined to agree with those who hold that for the present at least that work should be done largely by the experts at the Experimental Stations and that members of the Seed Growers' Association should confine themselves to hand-selection of the best heads taken from seed plots the seed for which may have come from the Experimental Stations and may have been propagated from the individual plant.

The production of good seed grain through the medium of the Seed Growers' Association is one of the best means of improving the agricultural conditions of the country, but in this work seed and soil must be jointly considered. Pure seed alone will not solve the problem of better crops, unless due attention be given the cultivation of the soil and the maintenance of soil fertility. By the judicious use of selected seed, with thorough cultivation of the soil, a suitable rotation of crops and the use of farm manures, the farmer can materially improve the yield and quality of his crops and at the same time conserve and utilize to better advantage the soil wealth of his farm.

Selection of seed with a view to producing earlier maturing strains has also proven effective. In the report of the second annual meeting of your Association, Prof. Webber, of Washington, D.C., points out the change that has taken place in the United States in regard to the manner in which the supposed limitations of areas suitable for different crops have been shifting and he expresses some surprise that fall wheat has been grown successfully at our Experimental Farm here. This same change is and has been going on in Canada. Our country is broadening out as a producer of wheat, corn, and other grains in a surprising manner and the efforts of our breeders in producing early ripening varieties of good quality is a work worthy of our highest commendation.

We have in Dr. Saunders, a man noted all over this country and other countries for his skill in the production of improved grains. We have in Prof. Zavitz, a man who has also attained great fame in this direction. We have good reason to expect that with these gentlemen and others working along similar lines we will be able to meet the conditions of our west and north. If these gentlemen can produce a grain that ripens a few days earlier they will render a great service not only to the north country but to the whole of Canada. That will be their gift to the community. There is a great field before them. We have the soil in Canada and we have the climate for a short rapid growth.

I should like to say a few words in commendation of the good work which is being done by the Seed Branch of the Dominion Department of Agriculture. One phase of the work and perhaps the most important phase is that of testing the vitality of seeds. It is impossible to estimate the loss which is sustained by farmers from sowing seed of low vitality and which is foul with weed seeds. Good service was rendered the farmers of the west and the whole people of Canada by the timely report of Geo. H. Clark, Seed Commissioner, on the low vitality of the seed produced in 1907. What might have been a second failure especially in oats and to a considerable extent in wheat and barley was largely averted through the information given the public in this way.

In the establishing of field competitions through the medium of the Agricutural Societies of the Provinces, a great stimulus has been given the good-seed movement and, judging from the interest that is being taken in these contests in Ontario and in the west, a great deal of good must result. As the Seed Growers' Association extends its membership, thus providing good and suitable varieties of seed, it will have customers in those farmers who wish to compete in these field competitions.

The good work which is being done by the Seed Control Act is also worthy of special notice. In Ontario this Act has been criticised. Some of our retail seedsmen have been telling the farmers that the Act has only served to enhance the price of seed. My own opinion is that this is quite the wrong conclusion. All Acts of this kind must work their way. To be effective, there is need of a strong power to enforce such an act. I am glad to learn from Mr. Clark that the enforcing of the Seed Control Act is to be taken up more vigorously in the future than it has in the past.

PAPERS BY DISTRICT REPRESENTATIVES OF THE SEED BRANCH OF THE DOMINION DEPARTMENT OF AGRICULTURE.

SEED GROWING IN THE MARITIME PROVINCES.

By S. J. Moore, Truro, N.S.

During the past season, all the plots of the 86 men whose names were on my list were inspected with the exception of about a half-dozen. These I considered were not worth visiting. Eight of the plots were inspected by Mr. Donald Innes while he was on Prince Edward Island judging the standing fields of seed grain. Of the above number, 24 were in New Brunswick and I regret to have to report that not more than five of that number are doing effective work along the lines laid down by the C. S. G. A. This is unfortunate since a high class of seed grain could be produced in many parts of new Brunswick.

In Nova Scotia the condition is somewhat more satisfactory. Out of a total of 23 members in that province, 10 are doing good work, although not raising large quantities of grain for sale except in a few instances. Here we have a greater variety of crops operated with than in the other two provinces. The members include, among their selections, oats, wheat, potatoes, corn, and two or three members are starting with Beans. The matter of corn selection is a very important one for this province as several sections are well adapted to the growing of corn for ensilage. The great difficulty at present is to get a variety of corn that will grow sufficiently strong and produce a goodly supply of foliage and, at the same time, mature the ear sufficiently to make good ensilage. The average season of Nova Scotia, although apparently long enough, will not mature corn so well as will other districts which have even shorter seasons. This apparently is due to the cool nights and the comparatively cool days. The work of our corn growing members, however, if carried on faithfully and intelligently, should do something to solve the problem.

In Prince Edward Island, out of a total membership of 39, we have 11 doing good work and many of them producing large quantities of seed for sale, especially oats, and it is to this province that the farmers of the other two provinces are looking more and more for their seed supply. A mistake our members seem to have made is in growing too many varieties of oats and in not producing enough of the varieties which the seed market demands. The Banner variety for example is at present a very popular oat in the maritime provinces and I have requests to-day for much more seed of this variety than is now produced by our members.

I do not want to have it understood that I act in any way in the capacity of a seed merchant. On the other hand I consider it my duty, when a farmer inquires of me as to where he can purchase good seed of a certain variety, to put him in communication with one of our members or some one else whom I know to be growing such seed.

Unfortunately, I have to report that three of our best selectors of wheat on Prince Edward Island are threatened with disaster through the ravages of the joint-worm, and unless conditions improve the only effective remedy as recommended by the late Dr. Fletcher—that of abandoning wheat growing for a time—will have to be resorted to. This is unfortunate as those members were doing good work and producing an excellent quality of grain.

Of the 39 names on our list for Prince Edward Island, no doubt several will be dropped this year and the balance will likely get into line. I am pleased to state that I have been able to secure the names of several young men, both in Prince Edward Island and Nova Scotia, as applicants who, from the appearance of their farms, will no doubt become good members. However, it seems difficult to get the best men with the best farms to take up this work on account of their being too busily engaged along other lines.

We have not been very much troubled with rust, smut or injurious insects—except the joint-worm above referred to—although the island farmers find it advantageous to treat both wheat and oats for loose smut and bunt. One of our members in Nova Scotia suffered from rust during the past season owing to the grain being sown late.

We have had the usual number of Seed Fairs since our last annual meeting and all have shown a substantial increase in the number of exhibits and an improvement in the quality of the seed. An increased interest is also being shown in the work by those who attend. The Annual Seed Fair at Summerside, P.E.I., March 18 and 19, was a splendid success in every way, the exhibit being a large one and the attendance good.

The exhibition of seed held in connection with the Maritime Winter Fair at Amherst, N.S., was an improvement over that of former years, the competition being exceedingly keen. Our Seed Commissioner, Mr. Clark, assisted us on the evening set apart by the Fair for a discussion of topics relating to the growing of farm crops, by delivering an address entitled: 'Seventy-five Maritime Farm Weeds.' Illustrations of these weeds in natural colour were shown by lantern slides.

Last summer the Department of Agriculture of Prince Edward Island, assisted by the Seed Branch of the Federal Department started competitions in standing fields of seed grain. A competition in both wheat and oats was held in each of the three counties of the Island. Although the notice was short and the farmers had little time to prepare for it, there were over forty entries. In these competitions the importance of hand-selected and other carefully grown grain was shown to advantage. With one or two exceptions the prize winning fields were grown with grain from hand-selected plots or from seed obtained through the Experimental Farm at Ottawa and carefully selected afterward. The Department of Agriculture for Nova Scotia has arranged for seven competitions in oats during the coming summer (1909) and no doubt New Brunswick will follow in the near future. This will mean an increased demand for seed such as is grown by members of the C. S. G. A. and should be an incentive for them to prosecute the work more vigorously.

While improvement was noted in the plots of many of our members yet there is still much room for improvement in many of them. A point which does not receive the attention it should by the majority of our members is the use of the fanning mill as a supplement to the hand-selection in the field. Much of the grain sown is not so uniform in size as it should be, thereby causing an uneveness in growth. Nowhere was the value of hand-selected grain so plainly shown as in some sections which suffered from protracted drought. While the straw was short the heads, as compared with those of other crops in the same district, were long and well filled.

SEED GROWING IN THE QUEBEC DISTRICT.

By J. C. Côté, Ottawa, Ont.

The last two seasons have been very unfavourable for the production of seed grain in Quebec. In 1907 the crops were visited by frost in the eastern part of the province, consequently a good many members lost their seed and were forced to discontinue the work of selection for the time being. Last summer (1908) the crops suffered excessively from drought and large areas of oats were injured through the 'Hot Weather Blight.' Very little grain, however, sustained injury from smut. While such conditions tend to delay the progress of your Association considerably yet very few members have abandoned the practice of selecting seed grain, which speaks well for the good work your Association is doing.

Allow me at this point to draw your attention to an important feature in the work of seed improvement which, in this province, is being largely ignored. I refer to the matter of soil cultivation and handling the crop. Among your members I have met some who are performing their work of selection intelligently but who, unfortunately, will not reap the full benefit from it owing to their failure to give due consideration to proper methods of soil cultivation.

An old and very bad custom, existing especially in the eastern part of the province, is the harvesting of the grain before it is mature. I have known even selected grain to show marked deterioration because it was harvested in this condition. The majority of the members carry on the selection of seed for the purpose of increasing its yielding ability; very few, however, apparently give sufficient attention to the matter of purity—freedom from other varieties—diseases, stiffness of straw, etc.

To insure more effective work on the part of new members or applicants, I desire to recommend that the Association help them as far as possible in securing seed of standard varieties as foundation stock.

Many old members that I have had the pleasure of coming in contact with, complain of the impossibility of securing more than the ordinary market price for their seed. However, a sufficient quantity of the selected seed has been sold to demonstrate its value and so, I believe, that this difficulty will soon disappear.

I have been able to induce a few farmers to undertake comparative experiments with some registered seed along with seed of indifferent quality. The results obtained have been greatly in favour of the selected seed, especially when such seed had been grown in the immediate locality. I am glad these experiments were a success as they have served to convince all those interested as to the advantages of this work.

The standing field competitions organized last summer by the provincial government at Quebec and assisted by the Seed Branch of the Dominion Government are among the most useful instruments in stimulating a greater interest among farmers in the production of high-class seed. Those societies who understood the purpose of these competitions did the work intelligently and in a praiseworthy manner. I trust that many of these competitors will eventually become active members of your Association.

The task of encouraging the use of high-class seed is a noble one. The saving of a few cents per bushel by the purchase of poor cheap seed means the loss of many dollars on the resulting crop, the sooner the farmers of Canada understand that fact, the better.

SEED GROWING IN THE ONTARIO DISTRICT.

By T. G. Raynor, B.S.A., Ottawa, Ont.

During the summer of 1908, I personally visited forty members or applicants of the Canadian Seed Growers' Association, all of whom had plots and were endeavouring to conform more or less closely to the rules of the Association. Eleven other growers at least were visited by Mr. T. H. Mason and one by Mr. Eddy.

Many of the plots visited proved to be very interesting as in former years and in very many cases are teaching useful lessons to those members who are doing the work. For instance, at a recent farmers' institute meeting held at Onondaga, Mr. Abraham Vansickle, who had been improving the Early Leaming variety of corn, but who for good reasons had to drop out last year, said that he believed the ideas he got from observing his seed plots had led him to make much better fanning mill selections of the other crops he is growing, and that increased crops had been the result in at least his fall wheat, oats and potatoes. It was his opinion that the methods adopted by the Canadian Seed Growers' Association for improving the field crops are right. It is largely the difficulty of securing efficient farm labour to enable a man to take the time and pains necessary, together with the lack of sufficient barn room, to keep the improved seed grain by itself, as well as the difficulty in keeping it pure when threshed by the larger mills that prevents a great many farmers from taking up the work. There is no doubt about the results being satisfactory if the work be followed up carefully.

Mr. C. R. Gies, of Heidelberg, was much interested in the results he had realized from planting seeds from heads of his Dawson's Golden Chaff wheat in which he had noticed four kernels in a spikelet the previous year. A large number of the heads produced from this seed were equally well filled this year. This feature I also noticed in a crop grown by a Mr. Campbell, of Maxville, last summer, and which was produced from registered Red Fife wheat which he had purchased from Mr. R. McKay, of the same place. While Mr. McKay's crop last year was rather light and poor owing to light soil and dry season, Mr. Campbell's was exceptionally good being grown on a deep moist, friable soil which the climatic conditions of this spring and summer greatly favoured. The heads in this crop were very large and many of the spikelets contained four seeds instead of three, as is most common.

Wm. Lewis, of Dunsford, a new beginner, who is improving the Siberian oats, observed two or three features worthy of note in connection with his work. In some of his oat selections he found three oats to the spikelet when only one, or two at the most, is common. The character of these oats did not seem, as yet, to recommend their selection as possibly there would be more meat in the one larger kernel which is ordinarily produced, than there would be in the three smaller oats, while at the same time the percentage of hull in the larger oat was less. The most noticeable feature was the effectiveness with which formalin, when properly used, prevented the development of smut. Mr. Lewis had treated all his hand-selected seed oats for smut and, having more than enough seed for his breeding plot, he had sown his surplus along one end of a field where he had sown untreated seed. The result was that scarcely a smutted head could be seen in the treated part, while in the untreated section the smut was very bad. The plants in the treated section were also distinctly two inches higher than were those on the rest of the field. To Mr. Lewis and those who saw it, it was a most convincing argument, first, that it pays to select plants, and secondly that it is wise to treat all seed for smut before seeding.

Mr. Harold Jones, of Maitland, who is improving potatoes, found a great difference between varieties in respect of their attitude toward blight. Three kinds of potatoes were treated alike and three applications were given, with the result that no two varieties exhibited the same effects. This lesson was further emphasized by Prof. Macoun's work with potatoes at the Experimental Farm.

Mr. J. W. Clark, of Cainsville, treated some seed potatoes with copper-sulphate before planting, while other seed received no treatment. The effects were quite noticeable on the vines from the treated seed in that these were much stronger than were those from the untreated seed.

The corn plots were unusually good this year and will doubtless give a good account of themselves in producing good vital seed. Most of the plots were quite satisfactory.

It was an off-year for barley. Some plots were not located where they should have been, and as a result the cold backward spring followed by the hot dry summer, caused a partial failure in some of them.

While the actual plot-growers did not constitute a very large percentage of the applicants in Ontario last year, the work is nevertheless strongly commended, and 'Forward' is our watchword.

DISTRICT OF ALBERTA AND BRITISH COLUMBIA.

By W. C. McKillican, B.S.A., Calgary, Alta.

The past season has been much more successful for the Canadian Seed Growers' Association in the province of Alberta than has any previous year. It is true that there is not as yet any pure-bred seed for sale by the members residing in this province. But there has been a marked increase in the interest shown, in the number of farmers who are starting the work of seed selection and more particularly in the demand for pure-bred seed. The work of the Association now demands recognition. Two or three years ago it met with indifference and lack of appreciation. Now, when the Seed Growers' Association is mentioned most farmers know and understand something of its work. That, I believe, is the first step toward a more general adoption of the methods of the Association. Men who will take hold of a new and unheard of scheme are rare, and sometimes the flighty and erratic are the first to be attracted. When, however, the new system has proved its utility and established itself in public favour, the average man, even though cautious, will consider whether or not he can apply it with success to his own operations. Thus, the past few years in the far west, while non-productive of results so far as your Catalogue of seed for sale is concerned, have been very fruitful in the establishment of a reputation for the Association, and in the creating of public recognition and favour. This, I believe, will make for the surest foundation for permanent future success.

The demand for pure-breed seed is the most noticeable feature of this development. I am continually being asked where really high-class pure-bred seed can be obtained. This distribution of samples from the Experimental Farms has done a great deal to supply this demand. To that source the farmers of the West owe much of the purest grain we have. Larger lots would be preferred, however, and people are quite willing to pay good prices for them. When your members rise to the occasion and produce a sufficient surplus over their own needs and have some pure-bred seed for sale, they will certainly find a hungry market waiting for them. This seed must, however, be first-class, if it is to hold the trade. The work of selection must be properly done, and care in handling the crop must be exercised to prevent mixing of unimproved or foreign grain with the selected seed.

I am pleased to be able to report that there is a growing effort to supply this demand. The number of hand-selected plots in 1908 is several times greater than in 1907. You have also now two members who have continued the selection so that in the near future they should have general-crop seed for sale. This will be the first grown in Alberta. Messrs. T. H. Woolford, of Cardston, and W. H. Pawson, of Coaldale, are the growers. They deserve special recognition for being the pioneers in this new work in a new country.

For the first time in this district, the Association has offered special prizes at the Provincial Seed Fair, to be held in Calgary February 3, 4 and 5, 1909. The competition will not be larger this year, but it is a step in the right direction and the exhibit will grow from year to year if the special prizes are continued.

The development of this work is slower in the province of British Columbia. Grain growing takes a very minor place in that province compared with fruit growing and dairying. The principal of selection is being applied with success in these other lines of farming, but they do not come under the scope of the work of the Canadian Seed Growers' Association. We have, however, a few applicants for membership in British Columbia who have as good a field to work in as have your members in any other province.

CAUSES WHICH AFFECT THE VITALITY AND THE VITAL ENERGY OF SEEDS.

By Geo. Michaud, Assistant Seed Analyst, Ottawa, Ont.

The subject treated in this paper is of indisputable importance to farmers and seed growers. General facts relative to it have been well known for over a quarter of a century. Much research work has been done and much has been written by many experimenters, but apparently little has been discovered in addition to what the German authors have taught us. The strong individuality of the seed, renders this kind of experimental work very difficult. If generalized, results of experiments on the germination of seeds are of questionable value unless they are obtained from a much larger number of samples and carried over many more years than is generally thought necessary, even by some technical men.

Our literature on the subject is mostly made of compilations. The numerous tables given for practical purposes, such as the average per cent of germination of different kinds or species of seeds, the number of years it takes some seeds to lose their vitality, etc., are in many cases contradictory. This shows the difficulty of making general rules pertaining to the vitality of seeds. In any case and for each sample, the most reliable information will always be the actual test.

WHAT DO WE UNDERSTAND BY VITALITY, VITAL ENERGY AND GERMINATION OF SEEDS?

Vitality is the ability of the seed to possess life and to produce a new plant which will grow and become strong, provided the seed is of high vital energy. *Germination,* strictly speaking, is the physiological process by which the oospore, or the product of fertilization in the ovule, germinates, producing the embryo plant. In general practice, however, the term germination has been extended to the resumption of growth of the embryo plant until it has broken through the seed coat. A perfect plant, in this stage of development, must be provided with the roots or radicle and the stem or plumule. It will feed on the nutrients stored for that purpose in the endosperm and will then take an independent, self-subsisting position.

Seed-testing stations generally give preliminary and final reports of tests of seeds. The preliminary report expresses the vital energy, the final report expresses the vitality of the seed. Any experiments with seeds after germination has taken place can hardly be conducted in the seed laboratory, unless a greenhouse or a field experiment plot is available.

FACTORS IN GERMINATION.

To germinate under ideal conditions, seeds must possess the inherent vital energy common to any living organism, the nature of which is still an open question to the scientific world. They must also be normally developed, both physically and chemically; physically, in order to allow water, heat and oxygen to penetrate through the seed coat into the interior of the seed, and chemically so that the non-assimilable nutrients stored in the endosperm may be transformed into assimilable ones through the action of the ferments or enzymes. These I may call the primary factors of germination.

What I have called ideal conditions for germination are the secondary factors of germination, i.e., the presence of water, heat and oxygen in a certain proportion, which proportion is different for each seed and cannot be determined for the whole species.

The reduction or destruction of any one or many of these factors will lessen or completely destroy the vitality and the vital energy of the seed. I may divide the causes so reducing or destroying these factors into natural and artificial ones, the natural resulting from the natural conditions, such as maturity, age, weathering, diseases, insects, etc., and the artificial from the action of man, for the purpose of securing, storing and treating the seed.

NATURAL CAUSES WHICH AFFECT THE GERMINATION OF SEED.

Degree of Maturity.—No seed will germinate until the embryo is ripe; that is to say, well formed and ready to use the nutrients stored in the endosperm, but the maturity of the embryo does not necessarily coincide with the maturity of the seed, as commonly understood, that means when the seed separates from the mother plant. While this may be the case with many kinds of seeds, in general what we call a ripe seed is ready to germinate if the secondary factors of germination are secured.

The delay which often occurs in the germination of fresh seed, the so-called *'dormant stage'* or *period of rest,'* is generally attributed to the non-coincidence of the maturity of the embryo and of the maturity of the seed. In fact, we know but little about the physiology of this period of rest. We can compare it to a sleep during which the physiological functions of the seed, such as respiration and transpiration, are reduced to their minimum, and through which nature proposes to help the seed in its struggle for life by delaying its germination until suitable location or climatic conditions have been secured.

The duration of this period of rest is longer or shorter for the different kinds of seeds and for the different individuals in each kind. In practice it is well known that some kinds of seed germinate better a few weeks, a few months, or even a few years after having been harvested. Seeds of cereals are generally able to germinate right after harvesting while some seeds of clover, for instance, will remain hard for weeks or months and in the meantime be useless for seed purposes.

In these last years, however, expriments conducted by Mr. William Crooker, of the Chicago University, seem to prove that the dormant stage is caused in general by the impermeability of the seed coat. Any cause destroying that impermeability, such as decaying, clipping, or otherwise breaking the seed coat, will allow the seed to germinate provided all other necessary conditions are present.* In practice, clover seeds or some vegetable seeds containing a large percentage of so-called 'hard-seeds,' i.e., seeds that do not germinate during the economically necessary period, are treated by special machines in which the seed coat is rubbed and made permeable to water. However, the seed treated in this way will not recover its full vitality because of the mechanical injury of the embryo of some seeds by passing through the machine.

To refer again to the maturity of the seed for seeding purposes, I may say that it is not advisable to sow seed that has been cut unripe. While reports of germination tests of such unripe seed will sometimes compare favourably with tests of ripe seeds of the same kind, they are misleading in so far as the value of the succeeding crop is concerned. Though the embryo may develop into a perfect plant, the vital energy of this plant will be doubtful and it cannot be expected that it will grow vigorously. The case is somewhat similar to that of a young animal deprived of its mother's milk in the first stages of its growth.

Another natural cause which will, under certain circumstances, affect the germination of seeds, and which is closely related to the period of rest, is the age of the seeds. No question pertaining to germination has been more studied nor has found more contradictory answers than this.

HOW LONG DO SEEDS KEEP THEIR VITALITY?

It depends so much on the year, the climatic conditions under which the seed is grown, the degree of maturity, conditions of storage, etc., that it is very difficult, if not impossible, to gather for experimental purposes uniform lots of samples from different countries. The practical tables, already mentioned and put up for the use of the farmers, give periods varying from two to ten years for the cereals and still more for other kinds of seed after which these seeds are supposed to have lost their vitality. We made experiments in our seed laboratory with samples harvested in 1901, 1902, 1903 and 1904, in the different provinces of the Dominion, and we found that the loss of germination with few exceptions was a very slight one until this year. Nearly every sample had strong vitality the first year the tests were made, but although the samples were kept in storage under the very best conditions, some of these seeds germinated better in certain years than in previous ones. We have not been able to find the cause of these irregularities.

As a general rule, so far as experiments and practice teach us, seeds of all kinds of plants lose their vitality and especially their vital energy as they get old. The development of the germ is much slower in old seeds than in new ones; instead of the root developing first, followed by the cotyledons and the stem, these latter organs grow first, the cotyledons unusually large and the plumule generally twisted, sometimes (in cereals for instance), growing a certain length under the seed coat or boring itself into the endosperm before extending outside. These anomalies in germination, which are due to the weakness of the embryo, delay the development of the young plant and it generally remains weak.

So far as it can be explained, the cause of the loss of vitality and vital energy in old seeds has to be accounted for by a premature chemical decomposition in the substance of the seed, which decomposition makes the embryo unable to feed on the endosperm or renders the endosperm itself inassimilable.

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* Some botanists have thought that these functions stop altogether, but I think this would result in a complete loss of life.

The loss of vitality in seeds that have been weathered, after full maturity, results also from similar chemical and premature transformation processes, under the simultaneous and repeated action of hot sunshine and rain.

Frost is an important agent affecting the germination of seeds. From the technical point of view, many theories have been given to explain the action of frost upon the grain. The most plausible one, in my opinion, is that the water contained in the cells, by expanding under the action of frost, breaks or distends the cell walls in such a way as to destroy the osmotic pressure that regulates the water content or the protoplasm in each cell. This causes a general disturbance in the economic and physiological functions of the different parts of the seed, very often bringing about the death of the embryo or its inability to use the nutrients of the endosperm, or some transformation in the endosperm which will render it unfit for feeding the young plant. The injury to grain by frost is very variable and depends less on the intensity of the cold than on the water content of the seed. It is, therefore, easy to understand that unripe, weathered or wet grain will suffer much more from a slight frost than will ripe and dry grain. In cases of slight frost, the vital energy only seems to be lowered. We tested in our laboratory many samples having suffered but little, and they gave quite a high percentage of germination. The process, however, was very slow and presented all the characteristics of the development of the germ of old seed.

Badly frosted wheat has a shrunken kernel; when slightly frosted the coat only will be finely cracked. To detect frozen oats is much more difficult and it often happens that apparently sound, plump, heavy and bright oats are so badly frozen that they will give but a very slow percentage of germination. A practical way to distinguish frosted oats, if they cannot be tested in the usual way, is to remove the hull and examine the naked kernel. The signs of frost are, first, the blackish, dull appearance of the kernel when turned towards the light; secondly, the black, dry embryo and the brittle nature of the endosperm when broken with the thumb nail and thirdly, when cut in two, a black line may be seen running through the longitudinal axle of the seed, like a very fine lead pencil mark. The necessity of testing oats for germination, even if they do not appear to be frosted, was proved once more by last year's experience. We know of many cases where farmers, having sown large areas of oats, could not discover the cause of the failure of the seeds to grow. Because of the good appearance of these seeds they never suspected them of being frozen.

In finishing with the natural causes injuriously affecting the germination of seeds, I have but little to say about *damage caused by disease or insects.* In such cases the destruction of the embryo or of the endosperm is merely a mechanical one. It is clear that the loss of vitality or vital energy will depend upon the degree of the injury.

ARTIFICIAL CAUSES OF LOSS OF VITALITY OF SEEDS.

As already stated, these losses have their origin in the threshing, storing or treating of the seeds before they are sown. Some of these causes are purely mechanical, others are chemical. Among the mechanical causes is the breaking of the seed by threshing, a factor worthy the consideration of seed growers, especially when small quantities of valuable selected seed are concerned. Seed that has been passed through a threshing mill is always injured more or less, according to the system and the regulation of the machine. The injury is done by breaking off portions of the kernel; this may destroy the embryo or the endosperm, partially or totally, or it may simply split the seed coat. In this case the fine splits prove to be very injurious when the seed is treated before being sown; then the chemical solution easily penetrates into the seed and destroys its tissues. Seeds injured in such a way may have a pretty high percentage of germination, but the vital energy of the young plants is often considerably lowered. Careful experiments made in European seed testing stations have shown that of untreated rye, wheat and barley, approximately, 32 per cent, 26 per cent and

16 per cent respectively of the seed was destroyed when threshed with a mill, while only 11 per cent, 9 per cent and 8 per cent respectively was destroyed when threshed by hand. Seeds treated by chemical solutions showed a still greater loss. These per cents include both the seed that did not germinate and the seeds that produced weak plants. A point to keep in view is that by threshing with the mill the largest, plumpest seeds—that means, the best seeding material—are injured in the greatest proportion.

THE STORAGE OF SEED GRAIN.

Storing will often result in great injury to the vitality of the seed if it be done under unfavourable conditions; if, for instance, the grain is stored when unripe or weathered or wet, or, even when in good condition, kept in a moist, hot place and allowed to heat too much.

The heating of the grain is probably due to the activity of bacteria attached to it as to the formation of diastatic ferments in the endosperm. The heating will not affect the germination of the seed if the temperature does not exceed about 100 degrees Fahrenheit. Experiments have shown that the diastatic ferments will lose their action when exposed to that temperature. As the degree of heating directly depends upon the water content of the seed and increases with it, the practical suggestion presents itself to dry the grain artificially before storing it, if the water content is too high and if the grain has not been dried enough on the stalk. The per cent of water in stored seeds, which varies greatly (sometimes 20 per cent to 30 per cent) with the degree of maturity and the climatic conditions, should be brought down to an average of 9 per cent to 13 per cent before storing.

The slower the process of drying, the better the result will be. The quicker the process of drying, the greater will be the chance of injuring the vitality of the seed. Seed injured by kiln-drying is recognized by its dark colour and its malty smell and flavour.

Dry cereal grain, being highly hygroscopic, will very quickly absorb the moisture, if there is any, in the place in which it is stored and *mould fungi* will soon develop on it, penetrate through the embryo and kill it. Here, again, the resistance of the seed grain to the mould is very variable; we know from our daily experience in the seed laboratory that old, weak seeds, or seeds the coat of which has been injured, will be attacked by the fungi much quicker than fresh, sound seed having a strong vital energy.

THE TREATMENT OF SEED GRAIN TO PREVENT CRYPTOGAMIC DISEASES AS A CHEMICAL CAUSE AFFECTING THE GERMINATION OF SEEDS.

It is a common practice to treat seed grain before sowing it to prevent the development in the young plants of fungous diseases. This is done by dipping the seed into hot water or into solutions of copper salts or of formaldehyde, and so on. In order not to injure the vitality of the seed, much attention must be paid in fixing the temperature of the water or the concentration of the solution used, as well as the time of the immersion. The moist heat having proved to be more injurious to the vitality of the seed than the dry heat, it is easy to understand that the so-called *hot water treatment* for the prevention of smut, for instance, requires great care. An immersion of ten minutes in water at 133° F. has already proved to be injurious to the seed grain to such an extent as to necessitate the sowing of double the quantity commonly used to the acre.

Numerous experiments have been made with seed grain treated with chemicals. The difference in the results obtained will be accounted for by the different conditions of the seed when experimented with, such as degree of maturity, variety, origin, etc. As it has been found that different varieties of the same kind of seed may be more or less resistant to certain diseases, we can logically expect similar differences in the degree of resistance of the seeds to the action of chemicals.

The aim of the farmer in treating his seed is to kill the spores of the disease, which stick to the seed itself, and in order to do it with certainty he will always be inclined to use the strongest possible solutions. Agricultural literature, experimental farm reports and bulletins give many methods of treatment, with the composition of the different solutions. Though this information is of great practical value to the farmer, the experiments having generally been made under the average conditions of the country, I would recommend in every possible case to test the treated seed grain for its germination, in order to ascertain, as nearly as can be done the loss of vitality, if any, and therefore the quantity to sow per acre.

After it has been sown, except in the case of extreme variation in the temperature or of absolute lack of moisture in the soil, or of damage done by insects, the germination of the seed will not likely be further impaired. However, the *use of commercial fertilizers* may sometimes prove dangerous. As we have never made any experiments in our Seed Laboratory relative to that factor, I may mention here that experiments have been carried on at the Division of Botany of the United States Department of Agriculture. The results showed that commercial fertilizers should not be brought into direct contact with germinating seeds and that fertilizers containing muriate of potash and sodium nitrate in strength of 1 per cent or more will be injurious, whether applied directly or mixed with the soil, while fertilizers composed of phosphoric acid or lime are much less injurious, or if not used in excess may be harmless.

Further, it can be seen from these experiments that the fertilizers which are going to be applied to the soil will not affect the seed itself before sowing in the same degree as they will the young plant. This is due probably to the fact that these fertilizers will attack the young plant as soon as it has broken through the seed coat, while they themselves are not able to penetrate through that protective covering.

I will close by reiterating the necessity of testing each and every lot of seeds before sowing, because of the already mentioned strong individuality of the seed. Should every kernel of a handful of any kind of seed be of the same size, the same specific weight, even contain the same number of similar cells and have the same chemical and physical composition, every seed would not necessarily have the same vital energy, the same affinity for certain chemicals, the same resistance against certain specific diseases or against any causes affecting its vitality and vital energy.

TO SECURE GOOD SEED.

Harvest it when well matured.
Allow it to dry naturally, or dry it artificially before storing.
Prevent mechanical injury by handling it as little and as carefully as possible.
Store it in a cool, dry, well ventilated place.
Be very careful in treating it with chemicals or with hot water.
Always test it before sowing in order to determine the proper amount to use.
Do not rely too much on its external appearance.

OBSERVATIONS ON THE BREAD-MAKING QUALITIES OF THE FLOUR MADE FROM DIFFERENT VARIETIES OF ONTARIO FALL WHEATS.

By Prof. R. Harcourt, O.A.C., Guelph, Ont.

Few people realize the number or the wide differences that exist in the quality of the numerous varieties of wheats grown in Ontario. As a rule the farmer favours the variety that will give the greatest number of bushels of wheat per acre, while the miller desires a wheat that will give a large yield of flour of a quality that will satisfy the demands of his customers. The variety which does not yield well but which has excellent chemical and milling characteristics is not desirable, neither is the variety which yields well but has poor chemical and milling properties. The ideal wheat is a heavy yielding variety having good milling and baking qualities. Yield naturally commands the first attention, but we cannot get away from the fact that the wheat is grown to be converted into flour which must have the necessary strength to produce a good loaf of bread. Therefore, quality of product must be combined with heavy yielding properties in order that our farmers may command the best price for their products. The work which I have to report was done with the hope of assisting in the determination of the varieties of wheat best adapted to our conditions.

Before taking up the results of our experiments, it may be well to discuss some of the common methods of estimating milling qualities and the strength of wheat and flour. Millers, wheat buyers, or others accustomed to handling wheat are, as a result of long experience, able to form a fair idea of the milling qualities of a wheat and the strength of the flour it will make from the appearance of the grain. Hardness, colour, plumpness, and an indefinable appearance which indicate strength or weakness in the grain are the points usually considered. Chewing the wheat to separate the glutent is sometimes practised, or the weight of the measured bushel is determined; while with flour many attempts have been made to estimate the strength by its granular condition or softness, by determining the amount of gluten, by doughing tests and by the expansion of the dough under the influence of yeast fermentation. But all these methods of estimating the strength of wheat and flour are, at best, crude, and while they may have a limited value in the hands of an experienced person, they do not form a basis upon which a close comparison can be made. The baker likes a flour which will absorb a large amount of water, yield a large loaf of a desirable shape, with good colour and texture. Such a flour is usually spoken of as a strong flour. But if we look deeper and attempt to define 'strength' in flour we find many conflicting views. *Jago defines strength as the capacity of a flour for absorbing water and treats separately the qualities of size, shape, colour and texture. Humphries and Biffin's †definition of strength is 'the capacity for making large well-piled loaves.' This definition suggest that the primary factor is size of loaf, the other factors being shape and perhaps, to some extent, texture.

Regarding the various suggestions for a chemical explanation of strength, Prof. T. B. Wood ‡ in a recent paper on 'The Chemistry of Strength of Wheat Flour' discusses the question as follows: 'The oldest idea suggested that strength was due to the gluten, which, in virtue of its tenacity, or perhaps viscosity, held in the bread the carbon dioxide produced by the yeast. No doubt a high content of gluten is frequently associated with strength, but there are so many cases in which a flour high in gluten is not so strong as another which contains less of that substance, that it can no longer be maintained that gluten content can be considered as a measure of strength. When the quantity of gluten failed to give the desired explanation, attention was turned to the quality of that substance, and it was examined both physically and chemically. The water-holding capacity of different glutens, as measured by the difference between the weight of the wet gluten immediately after extraction and its weight after drying, and the expansion of the gluten when heated to baking temperature in an instrument called the aleurometer, have both been credited with important bearings on the strength of flour from which the sample of gluten was obtained. No generally accepted regularity seems to have been demonstrated. On the chemical side, Girard and Fleurent suggested that strength depends on the presence of a proper proportion of gliadin, which they fix at 75 per cent of the gluten. Snyder put forward the same suggestion, but fixed his ideal ratio of gliadin to glutenin at 65 per cent of the former to 35 per cent of the latter. Finally, it has been suggested that it is not the ratio of gliadin to glutenin but the absolute amount of gliadin in the flour which gives the flour its strength. So contradictory are the results of different workers that the theory that gliadin was the basis of strength has never been generally accepted, and the analyses of Hall in the reports of the Home-grown Wheat Committee, in his paper in the Journal of the Board of Agriculture, have conclusively shown that as often as not gliadin determinations fail completely to indicate whether a flour is weak or strong. In fact, Hall in his address to the Millers' Association goes so far as to suggest that the name gliadin is little more than an 'analytical label.'

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* Jago, 'The Science and Art of Bread Making.'
† Humphries and Biffin, Journal Agricultural Science, Vol. II, Pt. 1, page 1.
‡ T. B. Wood, Journal Agricultural Science, Vol. II, Pt. 2, page 140.

Wood, basing his conclusions on considerable laboratory work, suggests an entirely new theory, i.e., that the size of loaf is not so much dependent upon the quantity or quality of the gluten as upon 'the amount of sugar contained in the flour, together with that formed in the dough by diastatic action,' and 'that shapeliness, and probably gas retention, are dependent on the physical properties of the gluten as modified by the presence of varying proportions of salts.'

From what has been said it is evident that our knowledge or rather our lack of knowledge of the chemistry of flour and breadmaking is another instance of the fact that many of the most common materials and every day operations around us are the least understood. Frankly, we do not know enough about the chemistry of flour or of the changes that the various constituents undergo in the process of bread making to devise any system of chemical analysis that will give conclusive and satisfactory evidence of the strength of flour for bread-making purposes. Therefore, the only method available for determining the relative value of flour for bread purposes is by actual baking trials.

It is, of course, evident that flour is also used for making biscuit and pastry and many preparations other than bread, and for some of these purposes flour made from winter wheats is equal to or superior to the harder spring wheats, but, as the greater part of all wheat flour is manufactured into bread, we will take the bread making qualities of the flour made from the various wheats as the standard of comparison.

The sixty-four varieties of winter wheats used in our tests were grown on the experimental plots of the Ontario Agricultural College, Guelph, in 1907, under as nearly uniform conditions as it was possible to have. The amount of wheat available was not large, but it was sufficient to make enough flour for three bakings with each of the varieties of wheat. We milled a portion of each sample in February of 1908, and when the flour was about two weeks old a portion of it was baked. About six months later a second baking was made. In November last, the remaining portion of the sample of wheat was ground and after the flour had aged for a short time, the baking trials were made. We thus have the results of baking tests with the freshly milled flour from wheat about six months old, with a portion of the same flour when it had aged to the extent of six months, and the freshly milled flour from wheat approximately fifteen months old. The wheat and flour were kept in tin cans in a dry, well-aerated room.

The results of the last baking test, together with the weight per measured bushel and the yield per acre of the various varieties as determined by the Experimental Department, are given in the accompanying table:—

RESULTS of Baking Tests and Yields of Ontario Fall Wheats, 1908.

Name of Variety.	Absorption.	Yield of Bread.	Size of Loaf.	Appearance.	Colour.	Texture.	Average Quality.	Wet Gluten.	Moisture.	Weight per Measured Bushel.	Yield of Grain per Acre.
	%	%	%	%	%	%	%	%	%	Lbs.	Bush.
Standard	47·0	100·0	100·0	100·0	100·0	100·0	100.0	25·61	8·54	....	....
Abundance	47·0	101·5	89·8	102·0	99·0	102·5	101·2	24·00	10·38	61·56	63·85
Auburn	50·0	102·0	103·9	99·5	100·0	95·0	98·2	26·00	8·09	65·88	40·45
American Banner	49·0	101·0	98·9	102·0	99·0	100·0	100·3	23·66	8·90	61·94	63·75
American Wonder	46·0	98·3	93·8	97·0	99·0	95·0	97·0	23·80	9·68	61·31	77·12
Arctic Junior	49·0	99·6	101·1	102·0	103·0	103·5	102·8	23·80	8·76	62·88	43 88
Amherst Isle	48·0	101·3	94·3	100·0	100·0	99.5	99·8	22·74	9·45	61·69	47·47
Bald Pootung	49·0	101·3	96·6	100·0	100·0	98·0	98·8	25·11	10·92	61·50	42·30
Banatka	51·0	100·6	100·6	104·0	99·0	100·0	101·0	28·47	9·57	63 31	49·97
Bearded Pootung	50·0	100·6	100·0	102·0	102·5	104·0	102·8	27·57	8·85	63·31	37·92
Beardless Rural New Yorker	48·0	100·0	91·5	100·0	100·0	100·5	100·2	24·42	9·55	61·88	63·75
Buda Pesth	53·0	100·6	109·7	107·0	101·5	106·0	104·8	28·33	9·35	62·75	45·92
Bulgarian	48·0	102·0	93·8	100·0	101.0	101·5	100·8	27·75	9·16	62·81	50·33
Clawson Longberry	49·0	101·0	85·8	96·0	98·0	96·0	97·3	26·40	9·25	61·56	61·93
Crimean Red	52·0	100·8	117·1	107·0	101·0	104·0	104·0	29·17	9 45	63·31	46·48
Dawson's Golden Chaff	49·0	101·3	94·9	98·0	99·0	98·0	98·3	25·14	9·55	61·94	60·63
Early Genesee Giant	48·0	99·8	94·3	101·5	101·5	100·0	101·0	24·75	10·42	62·06	51·88
Early Ontario	50·0	101·3	94·3	103·0	98·0	99·0	100·0	25·43	8·18	61·88	46·92
Early Red Clawson	49·0	101·7	91·5	98·0	100·0	97·0	98·3	24·97	10·02	60·06	48·18
Early Red Chief	49·0	100·6	93·2	100·0	100·0	100·0	100·0	26·88	8·35	60·56	46·43
Egyptian Amber	49·0	100·2	105·1	104·0	101·0	102·0	102·3	24·06	9 03	62·50	52·30
Economy	48·0	99·4	100·6	102·0	99·0	97·0	99·3	25·66	10·22	61 94	45·33
Extra Early Windsor	48·0	98·5	89·2	98·5	100·0	96·0	98·2	....	9·49	61·81	61·67
Forty-fold	49·0	100·6	88·1	95·0	99·0	95·0	96·3	24·06	8·36	62·00	62·77
Genesee Reliable	48·0	98·8	100·6	104·0	99·0	100·0	101·0	23·00	9·58	62·88	50·75
Geneva	48·0	98·5	102·2	99·0	98·0	96·0	97·7	24·74	10·12	63·13	45·92
Ghirka	50·0	101·5	105·7	102·0	100·5	105·0	102·8	26 74	9·32	62·81	37 72
Harvest King	49·0	100·0	102·7	102·0	98·5	95·0	98·5	23·00	9·58	62·06	48·18
Imperial Amber	49·0	100·4	98·3	103·0	98·0	100·0	100·7	26·97	9·45	63·00	40·70
Ironclad	50·0	100·4	98·9	98·0	98·0	100·0	98·7	30·38	7·99	59·19	35·50
Kentucky Giant	50·0	100·4	101·1	101·0	101·0	102·0	101 3	26·09	10·16	63·19	44·55
Manitoba Red Fife	49·0	100·2	113·2	103·0	100·5	101·0	101·5	26·73	9·33	61·63	42·62
Michigan Amber	49·0	101·9	101·1	102·0	102·0	104·0	102·8	24·78	8·46	62·00	48·20
Monarch	51·0	101·7	98·9	102·0	99·0	102·5	101·2	25·65	9·27	61·38	49·27
Mogul	48·0	98·8	89·2	99·0	101·5	98·0	99·5	25·72	10·16	61·94	60·23
McGavin	47·0	98·3	90·3	100·0	100·5	99·0	99·8	25·29	10·82	62·44	52·35
McPherson	50·0	102·0	105·7	104·0	102·0	101·0	102·3	25·74	8·62	61·63	44·13

RESULTS of Baking Tests and Yields of Ontario Fall Wheats, 1908—*Continued.*

Name of Variety.	Absorption.	Yield of Bread.	Size of Loaf.	Appearance.	Colour.	Texture.	Average Quality.	Wet Gluten.	Moisture.	Weight per Measured Bushel.	Yield of Grain per acre.
	%	%	%	%	%	%	%	%	%	Lbs.	Bush.
Neverkill	48·0	98·5	89·2	99·5	98·0	96·0	97·8	25·92	9·95	62·38	44·40
New Mammoth Amber	48·0	100·0	95·5	101·0	101·0	100·0	100·7	24·39	9·57	61·94	42·37
New Paris Prize	48·0	99·6	93·2	98·0	100·0	98·0	98·7	23·34	9·62	59·19	35·50
New Invincible	49·0	99.6	94·9	100·0	101·0	101·0	100·7	25·15	9·38	61·50	46·48
Nigger Wheat	49·0	100·0	90·9	100·0	102.0	105·0	102·3	27·66	10·42	62·31	41·87
Northwester	48·0	99·8	94·3	96·0	100·0	97·0	100·7	25·01	9·96	64·00	48·43
No. 5 Red Wheat	49·0	101·9	82·9	98·0	99·5	97·0	98·2	24·55	10·49	60·50	43·55
No. 8 Red Wheat	50·0	101·7	93·8	95·0	99·5	96·0	96·8	23·07	9·75	61·56	49·63
Onigara	49·0	100·1	100·0	102·0	102·0	102·0	102·0	26·06	9·63	62·88	37·58
Padin	48·0	99·8	98·9	100·0	98·5	99·5	99·3	24·42	9·87	61·50	49·25
Paramount	48·0	99·6	99·4	103·0	103·0	104·0	103·3	25·08	10.32	61·81	52·90
Prize Taker	48·0	98·7	88·6	96·5	98·0	96·0	96·7	21·71	8·82	61·88	62·73
Prosperity	49·0	98·5	93·2	97·0	98·0	98·0	97·7	24·81	8·66	61·50	48·13
Red Hussar	48·0	97·9	86·4	97·0	101·0	94·0	97·3	22·62	8·13	60·38	46·48
Red Wave	49·0	102·7	85·8	95·0	101·0	96·0	97·3	21·48	8·69	59·56	36·73
Royalty	47·0	99·6	98·9	98·0	100·0	98·0	98·7	23·88	10·46	61·63	51·33
Rudy	48·0	98·5	114·8	103·0	101·0	102·0	102·0	24·33	10·34	62·25	41·17
Russian Amber	48·0	100·6	93·2	101·0	101·5	100·0	100·8	23·19	10·51	62·56	48·98
Scott	49·0	102·0	103·4	102·0	101·0	104·0	102·3	26·97	9·36	61·56	41·43
Silver Dollar	48·0	98·3	93·2	101·0	102·0	102·0	101·8	23·55	10·36	60·06	47·47
Silver Sheaf—Longberry Red	49·0	99·6	88·1	98·0	96·0	97·0	97·0	25·26	9·32	62·44	44·10
Superlative	......	......	......	......	......	......	......	22·69	9·61	61·19	62·78
Tasmania Red	52·0	102·9	105·7	103·0	100·0	96·0	99·7	28·44	8·18	63·56	44·32
Treadwell	49·0	98·5	106·8	101·0	100·0	100·0	100·3	25·06	9·27	62·56	56·22
Turkey Red	49·0	102·9	101·1	100·0	100·0	100·0	100·0	23·04	9·96	62·38	49·85
Tuscan Isle	50·0	100·4	113·6	106·0	96·0	101·0	101·0	27·75	9·67	61·25	35·70
Yarsolot	50·0	100·4	103·4	105·0	94·0	102·0	100·3	28·49	9·21	63·13	46·40
Yenide	48·0	100·4	99·4	98·0	100·0	94·0	97·3	25·50	9·78	63·13	36·77

The machinery and appliances used in this work are essentially the same as that used by some of the larger milling companies on this continent, and consists of a scourer and dust collector, a mill for grinding the wheat, an electric proof and bake-oven, appliances for testing gluten, measuring the volume of the loaf of bread, and all necessary utensils for the proper carrying out of the work.

The scourer is about two feet wide and two feet high, but, small as it is, it has a two-screen shoe for the separation of foreign matter, a fan twelve inches in diameter, and a scouring cylinder eight inches long, and is connected with small dust collectors By means of this machine we can clean the grain as thoroughly as it is done in the large mills.

The flour mill consists of two pairs of six-inch rolls, a corrugated pair and a smooth pair. These are connected with feed rolls, and by means of a side lever may be brought together or apart as the operator may desire. On the centre of the machine there is an arrangement for sifting or bolting the flour. This may be started or stopped while the machine is running without affecting the rest of the mill. The sifter carries three screens which may be replaced by others of smaller or larger mesh to suit the nature of the wheat being ground or the product desired. They are so arranged that the course bran layers are retained on the top sieve and the flour sifted out of the bottom one. There is no purifier attached to the mill, consequently we cannot separate fine light particles of flour or specks of bran as completely as might be desired; but by careful attention to details we have been able to prepare a good granular flour of excellent colour. No attempt is made to determine the yield of flour from the wheat or to separate the flour into the different grades commonly prepared in the larger mills.

The electric proof oven is four feet by four feet by one foot in size, and contains three shelves. It is lined with asbestos and wired in two circuits, so that when both switches are thrown in, the oven may be warmed up quickly, and when one switch is withdrawn the temperature may, with very little difficulty, be held at any desired point.

The electric bake-oven is three feet square, inside measurement. The walls are lined on the inside with Russian iron and between this and the outer oak walls there are four inches of asbestos, thus insuring almost complete insulation. The wiring of the oven has been done in such a manner as to spread the heat from the electric current evenly throughout the oven and is of sufficient quantity to cause the temperature to be quickly raised to the required point.

To measure the expansion, or size, of the loaf, it is placed in a box of known capacity and all the vacant space filled with small seed. At the bottom of the box there is a slide which may be drawn to let the seed fall into a box with a long neck arranged in such a way that an accurate measurement of the seed may be made. The difference between the cubic contents of the first box and the amount of seed required to fill the space not occupied by the loaf must of necessity give the volume of the loaf.

In the baking trials nothing but water, salt, sugar, lard and yeast are mixed with the flour. Twelve ounces of the flour to be tested, with a level tablespoonful of lard, are mixed in a bowl with sufficient water containing the other ingredients to make a stiff dough. It is then well blended and kneaded on the board till smooth, without the addition of any more flour. This is placed in a proof oven, at a temperature of 80° F. until sufficiently risen to indicate that it is ready for kneading down. The kneading is accomplished without removing the dough from the bowl after which the dough is allowed to rise until ready for the pans. It is then shaped and placed in the pans and when risen to just the point that each individual flour will stand (some of the stronger flours take a much longer time to rise than the softer varieties) and placed in the oven and baked for one hour at a temperature of 360° F. The bread is allowed to cool, after which it is weighed, the volume of the loaf determined, and then cut and judged for quality. In these tests, the yeast is used in what might be considered excessive quantities. The object is to cause the dough to rise as high as possible and thus bring out the strength of the flour. The expansion, or the size of the loaf, is afterwards determined, and this, together with the texture of the bread, forms the basis for the judgment of the strength of the flour. The pans are made narrow so as to cause the loaf to take a high form in order to afford a better opportunity of judging the power of dough to expand. The use of electric proof and bake ovens renders it possible to have almost complete control of the temperature, and consequently, to carry out these comparative baking tests under uniform conditions. The flour tests also include a determination of the per cent of wet gluten and the amount of water the flour will absorb.

When this work is done by an experienced person, the slightest difference in the quality of flours may be determined. In every case the bread was compared with a standard which throughout this work was a straight grade soft wheat flour made in a large flour mill. The results are reported in per cent of the standard.

The results of the determination of yield of bread are naturally not so reliable as if a larger quantity of flour was used in each test; but they are fairly accurate when taken for purposes of comparison, and much better results can be secured on the other points with the small loaves. Very frequently the smaller loaves weigh the most. As all the loaves were made from exactly the same weight of flour, the difference in the weight of the bread must be due to difference in the ability of the flour to take up water and hold it in the bread when it is baked. The smaller loaf will, however, present less surface for the evaporation of water and the gluten, being either less in quantity or poorer in quality, the bread is naturally less porous or more sodden and thus heavier.

The strength of the various flours is more clearly shown in the column giving the 'size of loaf;' and the 'quality of loaf' is the average of the figures given 'appearance,' 'colour, 'and 'texture.' The largest loaf was got from the Crimean Red Wheat, which had a volume of 117·1 as compared with the standard at 100·00, and an average quality of bread of 104·0. Buda Pesth had a volume of 109·7 and an average quality of bread of 104·6; while Red Wave had a volume of only 85·8 and an average quality of 97·3. Prize Taker, Neverkill, Silver Sheaf Longberry, Forty Fold, Red Hussar, and several others are not much better. Among the well known varieties Early Genesee Giant, Egyptian Amber, Michigan Amber, Nigger Wheat, Scott, Treadwell, and Turkey Red gave results above the standard, while Dawson's Golden Chaff, Early Red Clawson, Clawson's Longberry, and American Wonder are below the standard.

Taking an average of the results, there appears to be same relationship between yield per acre, weight per measured bushel, and strength and quality of flour, as evidenced by the size and quality of the loaf it will produce. In order to bring out this point, we grouped the wheats into those yielding less than 45 bushels, and those yielding over 60 bushels per acre. The average results obtained in this way are arranged in the following table:

TABLE II.—YIELD OF WHEAT PER ACRE, WEIGHT PER MEASURED BUSHEL, AND QUALITY OF FLOUR COMPARED.

No. of Samples.	Yield per acre.	Weight per measured bushel.	Yield of Bread.	Size of loaf.	Quality of loaf.	—
10 above 60 bus.	63·84	61·78	99·97	91·05	98·5	
30 between 45 and 60 bus.	49·27	62·05	100·16	98·25	100·3	
23 below 45 bus.	40·52	62·19	100·65	99·39	100·3	

The above table shows that, taking the average of the results obtained, as the yield of wheat per acre decreased the weight per measured bushel and the size and quality of the loaf increased. This statement, however, cannot be applied to individual cases, for there are two or three of the very poorest bread-making wheats in the lowest yielding group. These are Red Wave, No. 5 Red Wheat, and Silver Sheaf Longberry. The Crimean Red and Buda Pesth which, as previously stated, are the best bread making wheats in the number tested, stand in the second group, and in the first group of wheats, which gave a yield of over 60 bushels per acre, we find Abundance, American Wonder, and Mogul, which gave a fairly good quality of bread.

Naturally the best variety is the one which will, all points taken into consideration, give the largest number of bushels per acre of grain, that will yield a large amount of flour of a quality suitable for making first-class bread. A study of the results will indicate that this variety is not the heaviest yielder, nor the one which gives the best quality of bread, but that it would be arrived at by a process of compensation between the two extremes. The data shows clearly that there are some very poor varieties on the list and that there are a number of others which will give good results to both the farmer and the miller.

Prof. SHUTT.—The matter of baking tests, as carried on at the Experimental Farm, is under the direct control of Dr. C. E. Saunders and consequently he is the one who should really lead in this discussion.

We have been looking into the matter of the influence of environment on wheat and we find it to be a potent factor in determining quality. In the northwest the nature of the season has been shown to have much to do with the proportion of gluten which the grain contains and we have now a fair amount of satisfactory proof to show that environment—I refer more particularly to climatic conditions—is more potent in influencing the quality of the wheat than is the soil. Our data are in line with those of other agricultural chemists in this regard; soil is secondary to climate in affecting the quality of the grain. Lengthening the ripening period, by excessive moisture and low temperatures, tends to the production of a starchy grain, in other words to the reduction of strength. Possibly this is as true in the case of winter wheat as in the case of spring wheat, but it is the latter only that we have investigated.

For some years we have been endeavouring to correlate the chemical data from the analysis of a flour with the baking results. Bulletin 57 of the Experimental Farm series tells something of the work we have done in that connection. It is an extremely complicated problem. The baking tests are necessarily largely a matter of judgment; in the chemical analysis the 'personal' factor is practically absent. Possibly we should not be far wrong in assuming that the amount of nitrogen is the best indication of strength, especially when considered in conjunction with the physical character of the gluten obtained by washing away the starch of the flour. Various theories have been advanced to account for 'strength' and we have examined and investigated many of them. Undoubtedly, there is a relation between the baking results and certain of the chemical results: a high protein content, a large proportion of wet and dry gluten (of good quality) and a high percentage of gliadin are indicative of good baking quality —that is of the ability to produce a large well-risen loaf. Our work in this matter has been intensely interesting, but it could not be discussed at any length before a non-chemical audience without spending more time than is at our disposal, in preliminary explanations. I have a strong hope that in the long run the chemists will be able to put the whole matter on a satisfactory basis. Already we have made considerable progress and the way has been cleared for still more fruitful work.

Before I resume my seat, might I ask Prof. Harcourt, how these glutens were determined; were they weighed as dry glutens?

Prof. HARCOURT.—No, these were weighed as wet glutens.

Prof. SHUTT.—What is the 'average quality' derived from?

Prof. HARCOURT.—The 'colour,' 'texture,' and 'appearance of loaf.'

Prof. SHUTT.—What points do you consider under 'appearance?'

Prof. HARCOURT.—The shape of the loaf,—whether it has a well rounded top,—and also the nature of the crust. The shape indicates to some extent the strength of the flour. A weak flour will very often make a loaf which falls in on top, giving a very poor appearance.

Prof. SHUTT.—This correlation of the chemical and baking results is a very important matter to all interested in wheat and flour. It is desirable therefore that every scientific institution that can find the time should prosecute such studies. It is a subject of almost national importance to us for we are becoming widely known as a wheat growing country. We should investigate as fully as possible our wheats, ascertaining their true bread-making value, and the influences that may affect the quality of those wheats. It will take a good many years, but I am glad to know that Prof. Harcourt has joined the ranks of the chemists who have undertaken this work. His paper is a useful one, but if he can correlate the baking tests with the chemical work, his results will be still more valuable.

Prof. Zavitz.—Prof. Harcourt has dealt with these as varieties of winter wheat. In the list is given the Manitoba Red Fife, which, however, is a spring wheat, which we have sown in the autumn and have grown as a winter wheat for three or four years. This stands second in size of loaf. One of the most important things mentioned is that there are certain exceptions to the general rule. There are certain varieties high in yield and also of good baking quality. That is probably the cream of the whole thing. The averages are not true in all cases. We are all watching for these exceptional cases. I wish to emphasize the point, that we should not draw too many conclusions from these tests because they show just the one year's work in yield and in weight per bushel and one year's results in baking tests. We have tested these wheats for a number of years for yield and I am afraid Prof. Harcourt's table gives undue emphasis to some varieties and withholds certain credit which is due others. When we get the yield of flour as well as its baking qualities, the information will be more complete.

Prof. Harcourt.—We got similar results to those described in the paper from the grades of wheat of 1905 and 1906, but my assistant who had charge of this work had not been accustomed to milling and handling soft wheat flours, and we were not satisfied with the results. Unfortunately this assistant left before the work was entirely completed, and we had to take a new person into the work. This lady is now experienced enough in both the milling and the baking of these soft wheats to get results which I think are reliable. Another year we hope to be able to collect data on the yield of flour from the wheat. In our little mill we cannot get yields such as can be obtained in the large mills throughout the country, but the results will be comparative and will, I think, add a great deal more information than can be got in the study of the baking tests only.

Dr. Chas. Saunders.—I wish to call attention to the general agreement between Prof. Harcourt's results and the results I obtained last year when making baking tests with varieties of winter wheat. Two points might be emphasized in connection with this problem. The shape of the tin employed has so much influence on the character of the bread that we cannot accept any conclusions obtained with one type of tin as necessarily being applicable to any other type. If you compare two loaves baked in tins with high sides, you may get valuable results; but the comparison of such loaves with loaves baked in what is known at the English 'cottage' style is useless, the cottage loaf being unsupported at the sides. The weight of bread obtained, the point to which bakers still attach the greatest importance, is necessarily related to the volume, larger loaves if made from the same weight of flour exposing a greater surface and therefore drying out more rapidly in the baking. This is particularly so, I think, where the bread is not supported or confined by the tin. We are obliged therefore to admit that what is perhaps the most important characteristics of all cannot be satisfactorily determined except when loaves of equal volume and baked in similar tins are being compared.

IMPROVEMENT OF CORN IN CANADA.

By Prof. L. S. Klinck, Macdonald College, Que.

The subject of corn improvement in Canada is a live one. The interest that has been awakened in this subject in recent years has been sustained by a pressing need. To offer some suggestions as to how the desired improvement may be effected is the object of this address.

We must, at this stage, deal largely in futures. As yet but little work has been done in this country looking towards the improvement of corn for different regions and for specific purposes. But little has been accomplished as the result of the carrying out of any systematic work extending over a period of years. Using the information available as a starting point I shall aim to direct your attention to the necessity of our conducting long-time breeding operations systematically planned and carefully executed. The work done to date, while far from being conclusive, is at least suggestive and a statement of the methods employed should prove helpful.

Let it be understood at the outset that I do not consider it advisable to attempt the improvement of dent corns for grain outside of a somewhat restricted area in southwestern Ontario. Flints, on the other hand, may be successfully grown for grain over a wide area, and wherever they can be readily matured attention should be directed to the improvement of those varieties which have demonstrated their adaptability to the requirements of the locality. The improvement of dent corns in this country interests us because of the increasing demand for a regular and reliable supply of seed for silage purposes, reasonably acclimated and reasonably dependable.

In the improvement of this crop two objects must be constantly borne in mind. The first and great essential is earliness, because quality is largely dependent on maturity; yield, while important, must be regarded as secondary. These two qualities are generally regarded as mutually antagonistic. To discover the happy medium should be our aim. In this work the farmers themselves must be the pioneers. Obviously it is out of the question for any experiment station to attempt the improvement of more than one or two varieties of corn. With the individual breeder, however, co-operation in a given district in breeding a single standard variety will reduce the danger from cross-fertilization to a minimum and will, at the same time, increase his chances for disposing of his seed at a remunerative price.

Yield and quality are always influenced by certain definite factors. Fertility, moisture, texture of soil and the prevalence of insects and plant disease all exert an influence but these factors must be regarded as secondary. Hereditary qualities are of primary importance. The former exert a temporary influence on yield; the latter being inherent, and therefore transmissible, influence yield permanently.

Good ears, then, are the result of heredity and environment. This principle being recognized, we can readily see that the chances for isolating individuals of merit are few if the selection is made apart from the growing plant. Productive individuals often owe their supposed superiority to exceptional advantages secured through an extra allowance of food, moisture, light and air. The influence exerted by these factors on the physical characters of such plants is not believed to be transmissible. In the improvement of small grains all plants so influenced are discarded and equal care should be exercised in selecting mother ears in corn. Not until our selections are confined to the best plants grown under normal conditions can we hope to make any real progress in isolating those individuals which owe their superiority to desirable hereditary qualities from those whose apparent superiority is due to favourable external conditions. Although corn responds readily to selection its improvement, while apparently simple, is very difficult of attainment. Manifestly it is impossible to effect permanent improvement without understanding the individual peculiarities of the crop under consideration. A basic study of established varieties is essential. Those demonstrating their inability to reach a definite standard should be rejected and attention should be directed to only a few superior varieties or strains. In many cases much time and energy has been expended and much money has been wasted in attempting to produce a type of corn which already existed. For example, I have found within the last four years in the province of Quebec two flint corns which for earliness and quality very nearly reach my ideal as to what constitutes a grain corn for Quebec. From the standpoint of yield these corns are capable of great improvement, but the point I wish to make is that ten years of breeding on my own part, with an inferior foundation stock, would probably have been required to reach the degree of perfection embodied at the present time in these two corns.

In improvement work, then, the first essential is to get the right foundation stock. As to what is right will depend upon the object the breeder has in mind. At present the range is wide enough, one would think, for any fancy. On our plots last year the Red Cob variety yielded at the rate of 17·9 tons of fodder to the acre while the Quebec Yellow yielded but 3·5 tons; in bushels of shelled corn the Red Cob yielded 17·5, the King Phillip 51·4 and the quality of the grain in the King Phillip was much superior to that of the Red Cob. The Howie, an early dent variety which closely approaches the Early Leaming in tonnage, produced 9·3 tons of fodder and 50·4 bushels of shelled grain per acre. From our results of the past three years the Howie gives great promise of giving excellent results where the season is too short for the Leaming.

All breeders recognize the fact that there is as wide a range between different strains in a given variety as there is between distinct varieties. Some families or strains are more prepotent than others. They are not accidentally good; they are inherently good. The fact that some families are low yielders can generally be accounted for by defects which manifest themselves in many of the progeny. Associated with low yielding strains we generally find a high percentage of weak, defective, stalks, numerous poorly-developed ears and a small proportion of ears giving evidences of good breeding and fixity of type. The following results taken from our records on the Quebec Yellow, a twelve-rowed flint which we have been breeding by the ear-row method for the past two years, will emphasize what I have said with regard to the superiority of certain strains. Ear 23 yielded at the rate of 57·5 bushels of shelled corn per acre; Ear 2 yielded 35·2. Ear 7 produced 11 barren stalks, i.e. stalks which did not produce an ear. Ear 8 did not have a single barren stalk. Ear 9 produced 20 broken stalks, i.e., stalks which were not strong enough to support their own weight. Ear 30 had but 2 broken stalks. Ear 3 produced 9 seed ears, i.e. ears of exceptional quality. Ear 4 produced only 2 such ears. Ear 28 gave 107 marketable ears. Ear 20 gave 69. Ear 4 yielded 31 nubbins, i.e. worthless ears. Ear 15 gave but 7. When we remember that this corn has been carefully selected for years by one of the members of this Association, Mr. W. L. Davidson, we can readily see the great possibilities for improvement in this crop. Equally striking differences manifested themselves in many other important points covered by the records.

Three systems are quite generally followed in improving corn—the farmer's breeding block, the block method and the ear-row method. The first two mentioned systems I have dealt with at considerable length at former meetings of this Association.* I shall now direct your attention to the ear-row system of improvement.

The selection of mother ears should always be made in the field, never from the crib. When the ears are selected in the field attention can be given to the character of the stalk. The type of stalk and ear chosen will depend upon the use to which the corn is to be put. Ears borne at a convenient height for husking on leafy, well-developed, slighty-tapering stalks will produce progeny less liable to lodge or blow down in seasons of heavy rainfall and high winds. Ears borne low indicate early maturity and the stalks bearing them are generally fine; ears attached high on the stalk are usually coarse and late in maturing. While we like to see evidences of breeding and fixity of type in the mother ears, utility should be made the determining factor in the selection. An ear of good substance with plenty of corn in the central part is to be preferred. The kernels should, in the case of the dent corns, be broadly wedge-shaped in outline. The degree of roughness of the ear is a fair criterion as to the time of maturity of the corn. The more pinched or hooked the dent the deeper, as a rule, is the kernel and the later in maturing is the corn.

If a large number of ears have been decided upon as being eligible for mothers it will be necessary to reduce the number to, say twenty-five. To facilitate the work of getting out the choicest ears the score card can sometimes be used to advantage as a help to determine those physical characters which denote usefulness and not for the discovery of fancy points. In making this final selection it should ever be borne in mind that the performance record of the progeny is the final determining factor and not the record of the individual ear.

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* Second Annual Report C. S. G. A., page 58.

After the ears have been decided upon they should be arranged in order of their conformity to the type the breeder has in mind. The butt and tip kernels are then discarded and the remaining grains shelled by hand to avoid injury. The grains from each are then placed in a small bag which bears the number of the ear. At planting time the first two rows in the plot are planted with corn taken from the best of the discarded ears. These rows are not taken into consideration in the results. The main reason for planting them is to protect row 1 from injury and also to give it no undue advantage over the other ears in the test by reason of its having more food and moisture. The hills are 42″ apart each way, five kernels are planted to the hill. Each ear plants but a single row. When five rows have been planted the sixth, or check row, is put in. This I consider a very important precaution and one all too frequently overlooked. Even with the most careful attention given to the selections of the soil for the breeding block in order to secure uniformity in fertility, contour and drainage some irregularities are almost certain to be present. In all such cases the presence of a check row of uniform composition frequently throws much light on the behaviour of certain ears.

Special care must be taken to insure the greatest uniformity in the sample which is to be used as the check row. A bulk quantity of seed would indicate but little because it would be impossible to put into each row the same number of kernels from each ear. This difficulty is overcome by taking ten of the discarded ears and shelling each separately as was done with the mother ears. If, then, the rows are 50 hills long the first five hills in the check row will be planted from check Ear 1, the second five from check Ear 2 and so on for fifty hills. In this way the check rows are comparable because their composition is the same. As an additional precaution against inequalities in soil the breeding block should always be planted in duplicate. This applies particularly to experiment station work. A label bearing the number of the mother ear stands at the head of each row to facilitate comparisons and record keeping.

When the plants have reached a height of about ten inches the smaller ones in each hill are pulled out and only the most thrifty ones are allowed to remain. Three stalks to the hill are considered a full stand.

When the corn begins to tassel all weak, broken or barren stalks are detasseled before any of their pollen is shed. This necessitates going through the plot three or four times at intervals of several days. By taking this precaution the danger of having strong ear-producing stalks fertilized by nubbin-bearing or worthless stalks is reduced to a minimum.

Some follow the system of detasseling alternate rows and at husking time reserving seed from only the most productive detasseled rows. This plan has not, as yet, met with favour in this country as it lessens the yield and lowers the quality of the corn for the first year. However, it has been demonstrated in Illinois that a marked increased in yield was obtained where this system was followed for a number of years. Undoubtedly our system of detasseling only the defective stalks admits of some inbreeding and also of considerable close breeding but since we never work with less than twenty-five ears the chances of lowering the vitality of the strain are greatly reduced.

At husking time full notes are taken on the progeny of each mother. In addition to date of husking, height of stalks, leafiness, per cent stand, number of rows per ear, number of barren, broken or smutted stalks, maturity of ears, height at which ears are borne, number of seed ears, of marketable ears and nubbins, there is recorded the yield of fodder and shelled grain per acre and the percentage of corn to cob.

A high-yielding ear must necessarily have very few serious defects; on the other hand, an ear is occasionally found which will throw a remarkable number of show ears although its total production of grain is low. Such an ear was the one I selected as being the best ear, so far as physical characters would indicate, when I made our first selection in the fall of 1906. This ear produced in 1907 a much larger number of seed ears than any other mother but the total yield was very disappointing.

After the best balanced rows have been discovered a number of their choicest ears should be reserved for next year's planting. It is not good practice to plant all the selected progeny from one mother, side by side in the breeding block of the second year. The ears of the different strains should alternate so as to prevent too close inbreeding.

What the Babcock test is to the dairyman, the trap nest to the poultry man, the centgener to the breeder of small grains, the ear-row test is to the breeder of corn, whether his aim is an increased yield in grain, in fodder or in both. At present no work is being done in Canada with a view to changing the chemical composition of corn, and while we are interested in perfecting early maturing grain corns for northern districts we are most interested in the improvement of those varieties which will best meet the demands of stockmen for an early-maturing high-yielding corn adapted for silage purposes.

Mr. Moore.—Is it necessary to plant every kernel of the ear of corn? A grower in the Annapolis Valley claims that after taking the seed only from the centre of the ear and throwing away the butt and tip kernels that after a few years the ears did not fill. Is this true?

Prof. Klinck.—It is popularly held to be true but it has no foundation in fact.

Mr. Shutt.—It would seem desirable that we should know the varieties that contain the most protein and the least amount of water. In considering the value of a variety for the silo, would it not be necessary to analyse the whole corn plant? Of course that could only be done at an experiment station or at an agricultural college where there is the proper equipment. I do not think it desirable to draw final conclusions as to the feeding value of a variety when intended for the silo simply from the appearance, etc., of the ear.

Prof. Klinck.—In the improvement of this corn for ensilage purposes, we are growing it to see whether the corn will become sufficiently advanced to mature seed from year to year. That being the case, no chemical analysis is made.

Mr. Shutt.—I would merely emphasize the fact that chemical work must go hand in hand with field work in such matters, if the results are to be conclusive or valuable from the feeding standpoint.

Prof. Klinck.—While we have no data based on a chemical analysis of these corns, we know that a variety such as the Mastodon, or Late Leaming will, as a rule, give a sour silage. Certainly a chemical analysis of the stalk and ear is the best way to determine the feeding value of different corns. However, a careful study of the physical characters of different corns will always prove of great value to the feeder. As ears low in protein or high in oil can readily be separated from ears high in protein or high in oil simply by a study of the physical characters of the kernels, so an experienced corn grower can select a variety high in feeding value from one of inferior quality. This is the point I wish to make, and I think the samples before you will illustrate my meaning.

Mr. Duke.—Prof. Klinck need offer no apology in presenting at least once a year an address on corn. The subject is of paramount importance to this part of the country. I am at the present time shipping hay to the Ottawa Valley. The only way to overcome the scarcity of this kind of food is to plant more corn. Most farmers plant one peck to the acre. If they would plant one peck to two acres they would fill more silos with corn. Before this Association was started, there was no really good seed corn grown in Canada except in an incidental way. Until two years ago the leading seed houses advertised that they did not use Canadian seed corn. They were ready to argue that it was no good. They said the climate of southwestern Ontario was too damp to allow it to mature. Now they are eager and ready to buy all the Canadian seed corn they can obtain. The seedsmen of Toronto will pay from two to ten cents per bushel more for Canadian than for Nebraska corn. It has proven hardier and more suitable to the conditions here. Corn responds quickly to environment and seed should, therefore, not be secured further from home than is necessary. It would be better, for instance, to bring corn from Ohio to Essex, then to London and then up here to Ottawa, rather than to bring it direct from Ohio to this part of the country. The people in the southwestern part of this province are, as a rule, very careless in regard to taking proper care of their corn. Improvement is becoming more evident, however, every year, especially in the handling of corn. I find that where two or three years ago one man undertook the selection of seed, to-day he is the centre of a little community who are operating in their own way and trying to improve along their own ideas. I feel, however, that the rules of this Association should be modified. If the seed plot were reduced to say 25 per cent of its present size more people would undertake the growing of seed corn along the lines of this Association. I believe that the time will come when all our corn growers will be corn breeders, but I think the Association will have to reconsider that rule.

THE PRODUCTION OF IMPROVED VARIETIES OF CEREALS.

By Charles E. Saunders, B.A., Ph.D., Cerealist, Dominion Experimental Farms.

The efforts that are being made on the Experimental Farms and elsewhere to improve cereals may be conveniently considered under two heads: first, attempts to produce or to isolate improved sorts by some form of mere selection from such varieties as are already available and second, the production of distinct new types by cross-breeding, followed of course by proper selection. The first method can be hopefully followed when we have on hand, as starting points, varieties which are fairly satisfactory and of which therefore we do not need to change the characteristics in any very radical way. The second method is essential when we desire to obtain such combinations of characters as do not at present exist. Selection enables us to make the best use of what we already have, while cross-breeding produces new sorts.

THE PRODUCTION OF IMPROVED VARIETIES AND STRAINS BY SELECTION.

The meaning of the term *variety* as applied to cereals is pretty well understood, but the work *strain* may need some explanation. I use this word to signify a subdivision of a variety. Even when we possess pure seed at the start we may by selection obtain types which though very clearly similar have certain points of distinction. The selections within a single variety may conveniently be termed *strains*. If, however, the original seed with which we commence our selection experiments consists of a mixture of clearly distinct sorts, then selection if properly carried on will enable us to isolate these various types, some of which may never before have been grown in pure condition. It is clear therefore, that by selection we usually obtain new strains, but occasionally new varieties.

METHODS OF SELECTION.

Selection may be practised in two rather distinct ways. We may either carry on repeated selection year after year with a view to obtaining slight but repeated advances in some particular direction or we may once for all pick out a number of specially promising plants or heads or seeds and propagate from each of these separately, without further selection, but retaining, after a few years' study of them, only that strain which has proved best. By one method we try to improve the whole mass as such; by the other we merely seek to discover, from the study of its descendants, which was the best plant in the whole original mass and to retain ultimately only the pure descendants of that plant, all the inferior strains being discarded.

The method of repeated selection is the same in principle whether we choose each year the largest or heaviest or hardest kernels or the largest or earliest heads—or on whatever character we may base it. At first sight this system seems so full of promise that one is not surprised at the number of experimentalists who have made use of it.

It fits in so well with the Darwinian ideas which have dominated the whole realm of biology for so many years. If natural selection has done so much, why may not artificial selection accomplish even more and in far shorter periods of time? While no one can set the limits of what can be done by repeated selection in any direction, the results which have been obtained have proved that the advancement is usually much too slow for ordinary purposes. This method was most carefully tested in Sweden, at the famous experiment station at Svalöf, but was finally abandoned as practically useless. Other workers elsewhere have been equally disappointed. While it certainly is of value in some cases, one must beware of expecting too much from it and must clearly recognize its sharp limitations and the dangers which always attend its use.

Of late years some new ideas in regard to the origin of species have been made prominent, especially by De Vries; and we have been led to think less of the importance of gradual changes in large masses of plants and more of the value of sudden changes in individuals. We now recognize that each plant has a measure of individuality, usually slight and unimportant, but occasionally so striking as to be easily observed. As these points of individuality are often transmitted to all the descendants of the original plant, we are generally able to obtain some strains of unusual value by keeping separate the progeny of each selected individual which was chosen because of some element of apparent superiority over the others. This second method of selection may perhaps not inappropriately be termed De Vriesian.

Personally I am a firm believer in the superiority of this method over the first, or Darwinian, whenever the original seed with which the work is commenced is in pure condition—true to name; because the method of repeated selection has some serious disadvantages, quite apart from the fact that the improvements effected by it are much too slow. In the first place one is obliged to decide every year, when the time for selection arrives, which are the best seeds or heads or plants, as the case may be, the decisions being based on appearance or weight or some such characteristics, while one is unable to take into consideration that quality which is perhaps the most important of all, namely the power of these selected individuals to transmit their own peculiarities to their progeny. Animal breeders know that the best looking animal does not always prove the most satisfactory parent.

In the second method of selection the original choice of a number of individuals is open to the same objections as were urged against the first method. But in the second method the original choice is only of a provisional nature, the final selection of the best strain not being made until after all the most promising strains have been propagated and studied for several years.

Both systems of selection have been used on the Experimental Farm at Ottawa, but the method of repeated selections for the improvement of varieties has been abandoned. A few years ago, when plots produced by the two methods were sometimes grown side by side, the difference in uniformity of appearance was strikingly in favour of the plots which had each been bred from a single plant.

The greatest danger in any form of repeated selection is that desirable qualities may be lost in one direction while a gain is being made in another. If for instance we always select the largest seeds these may be the product of the plants with the smallest heads, and we may in time materially reduce the productiveness of the selected grain. If the longest heads are chosen, these may come from plants with unduly long straw, which may be undesirable. Earliest heads, if we are selecting for earliness, may be from plants of otherwise poor quality. Again, in wet seasons one necessarily selects those individuals which can best withstand an excess of moisture and in dry seasons one must choose the opposite class, the work of one year thus conflicting with that of another. The danger of selecting false heads or kernels of an undesired variety in mistake for unusually large heads or kernels of the desired sort is very great.

The advocates of repeated selection may object, however, that undue emphasis is being laid on the dangers of this method and that in actual practice it has been found to give excellent results in some cases. Of course it is true that striking improvement can easily be produced by the selection of heads, for instance, even for a single season, provided that the grain with which the experiment is started is badly mixed. Strictly speaking, however, this is not *improvement* but *purification*, and such instances can scarcely be said to furnish a fair argument. Purification of seed is of great importance but a fair test in regard to the improvement of a variety cannot be begun until after pure seed has been obtained.

One other kind of instance should be mentioned. If for a long series of years we carefully select any particular type of head or seed we may finally reach a point where the greater part of our selected crop consists of the descendants of that plant which in the first year was the most productive of all those of the desired type. In other words, the selection of best typical heads year after year may ultimately bring us very close to the point which we could have reached by the other method of selection in a much shorter time and with very much less labour.

While fully admitting the value of the ordinary method of the selection of heads for the purpose of purifying mixed grain and for the maintenance of the seed in a high state of purity it does not seem to me to be the best way to bring about real improvement in any variety. The selection of good typical heads, rather than of heads which are in any way unusual, seems to be the safest and best plan. If a strain of different type is being sought for it is best to breed a number of separate strains each started from a single plant which appears to possess the desired qualities. One can thus usually obtain, at a single step, some distinct and permanent advantage and can make sure before the final choice of one partic[illegible]rain is made that in effecting an improvement in one direction nothing essential has been lost in other ways.

The work I have been doing with Red Fife wheat may serve as an illustration of the practical value of this method. It was desired to obtain a selected type of this wheat which should ripen earlier than the original variety but still retain its striking ability to produce strong flour. Early-maturing heads were therefore picked out and from each of these a new strain was produced. For several years the new strains were studied in the fields and having been at last reduced to four they were subjected to milling and baking tests. As a result of these tests we know that the selections B, H and M, which are still being grown, are genuine Red Fife so far as baking strength is concerned. Strain M does not show any particular earliness, and H is only a trifle ahead of ordinary Red Fife, but B is distinctly earlier. Though the advantage of Red Fife B is only a few days, and under some conditions may be scarcely noticeable, it is likely to be of great importance for certain sections of Canada. This wheat is to be introduced, under the name of Early Red Fife, as soon as practicable. The small quantity of seed on hand makes any distribution of it impossible at present.

CROSS-BREEDING.

The second section of my subject deals with the production of improved varieties of cereals by cross-breeding. As the details in regard to this method have been fully explained in the reports of the Dominion Experimental Farms and as it is a kind of work which cannot as a rule be profitably taken up by private individuals it is perhaps unnecessary to describe it here. It may be sufficient therefore to point out that this method is essential for the production of radically new varieties; and that by the use of it we may fairly expect to produce any new combination we desire of the characteristics of existing sorts. Cross-breeding of course must be followed by selection for several years in order to obtain fixed types. The method of selection used is similar to that which I have just been advocating. The seed of each plant saved is always sown in a group by itself, and this process is repeated as often as may be necessary until finally one or more fixed, uniform groups are produced from each cross. As many of these groups as are desired may be retained but each must be propagated as a separate variety. Usually from four to six years elapse before groups are obtained which are quite fixed in regard to the eight or ten characters which we commonly observe in cereals. If the work were done on an enormous scale some fixed groups could be obtained at an earlier stage. Cross-breeding occasionally produces what may perhaps be fairly called new characters but as a rule we obtain only new combinations of the characters of the parents.

If you have carefully followed my remarks, you will see that a consideration of this important subject, both from the experimental and the theoretical sides, forces upon us the conclusion that we cannot, in the strict sense of the term, *improve* our cereals to any appreciable extent; and that all we can profitably do is to isolate and keep pure the very best strains which can be found, or, when nothing suitable to our purpose is available, we can by cross-breeding produce such new combinations of characters as we desire. The task of producing new varieties or of isolating the best strains of older sorts seems to belong to the seed specialist, though certain parts of this work are perfectly feasible for any enthusiastic farmer who desires, and can spare the time, to make a hobby of it. Most seed growers, however, would probably do better by testing on their farms a few different varieties of grain, choosing those most suitable to their own conditions, and then confining their attention to the maintenance of the purity of each sort grown. This, of course, pre-supposes that at least a small quantity of seed of each sort can be obtained in pure condition to begin with. This can usually be done without very much difficulty.

MAINTAINING THE PURITY OF GRAIN.

For the maintenance of [illegible]ty of his grain a farmer may select heads every year, if he thinks best, but [illegible] much easier method and one which is almost or quite as effective is available. Let him choose a particularly clean and fertile piece of land and sow on it his best seed for a special seed plot, stopping up about every eighth spout in the seed drill so as to facilitate walking through the standing grain later in the season. An acre or two may be sown in this way—enough to provide all the seed required for the following year. This seed plot should be gone through once or twice during the growing season and everything that looks false to the desired type of grain should be removed. This should be done again just before the grain is cut. The task may appear formidable to any one who has not tried it, but it is really by no means difficult. The special grain must be threshed separately after the threshing machine has been cleaned out as well as possible. It is highly desirable to thresh the special seed after some totally distinct grain, so that if any kernels remain in the machine and are carried over into the special seed they may be easily seen and separated. Wheat, barley or oats could, for instance, advantageously follow peas. The seed grain should be well cleaned in a fanning mill and as much of it as is to be used the next year for the special seed plot should be hand picked—an easy matter considering the small quantity required. In this way any farmer can keep his seed grain in excellent condition and can maintain its purity with the minimum of labour and with no danger of altering the characteristics of the variety by errors in selection.

The ideas here put forward in regard to seed selection may not be altogether in accord with those held by most of the members of this Association. I wish therefore in closing to state that while the maintenance of the purity of seed grain and the propagation of such seed should in my opinion be the chief aims of the Association rather than the continuous improvement of varieties by repeated selection, I am a firm believer in the value of the work which this society is doing. My views have not been advanced for the purpose of limiting but rather of greatly increasing the usefulness of the Association; for, in so far as these views are correct, their adoption would be sure to extend and broaden the sphere of its labours and give to it such an impetus as would be to the advantage of the whole country.

I wish to thank the Executive of the Association for inviting me to address you on a subject in regard to which my views were known to be somewhat at variance with theirs. I have endeavoured to return the courtesy by dealing frankly with the whole matter and I trust that in so doing I have not seemed too dogmatic and have not used any expressions which can give the slightest offence to any one.

THE IMPROVEMENT OF FARM CROPS BY THE SELECTION OF INDIVIDUAL PLANTS.

(By Prof. C. A. Zavitz, Agricultural College, Guelph.)

I would like to say something to correct an error in the report of the discussion of the address which I gave at the Annual Meeting of this Association in 1908. On page 46 of the Fourth Annual Report I am quoted as making the following statement:—

'In connection with our work, we have handled thousands and thousands of plants and have selected many individual plants, but we have not obtained as good results as we did from the original stock.'

Not only is this incorrect in connection with our own work, but it is also incorrect in regard to the work of plant selection generally. While it is true, that in some instances, we have been unable to secure strains from the individual plants which are superior to the original varieties, we have in most cases obtained new strains from selecting plants which are considerably superior to the varieties from which the plants were selected.

During the past few years we have given a good deal of attention, at the Ontario Agricultural College, to the improvement of our farm crops. This has involved a work, not only in endeavouring to attain a thorough knowledge of the varieties already existing in this country and in others, but also a systematic selection and the cross-fertilization of the leading varieties with the object of improving the very best which we are growing at the present time. We have started a considerable number of new strains of cereals by selecting the most promising individual plants out of thousands which we have grown and examined. It is only within the last two or three years that we have been enabled to compare our selected strains started from individual plants with the regular variety work in the experimental plots at the College. In nearly all cases we have been enabled to produce new strains which have given higher yields per acre than the variety from which the selections were made. This, however, has not been true in all cases, as in a few instances we have not yet secured new strains which are superior to those which we have grown previously. The following table gives the average of two and three years' results of the leading selected strains in comparison with the original variety in the case of a number of different varieties and classes of farm crops:—

Class of Crop.	Variety.	Number of years.	Yield of Grain per acre. (bushels.)	
			Standard variety.	Selected strain from Standard variety.
White Oats	Siberian	2	77·2	81·6
Black Oats	Joanette	2	70·2	82·0
Early Oats	Daubeney	2	84·9	87·8
Early Oats	Early Ripe	2	67·7	81·6
Six-rowed Barley	Mandscheuri	3	79·1	81·3
Two-rowed Barley	French Chevalier	3	51·8	47·9
Hulless Barley	Guy Mayle	3	40·0	40·5
Winter Wheat	Dawson's Golden Chaff	3	49·1	59·5
Winter Wheat	Bulgarian	3	37·2	38·0
Winter Wheat	Early Genesee Giant	3	42·5	44·2
Winter Wheat	Imperial Amber	3	40·7	40·6
Winter Wheat	Turkey Red	2	42·7	47·4
Spring Wheat	Red Fife	2	32·1	33·8
Durum Wheat	Wild Goose	2	29·4	28·3
Durum Wheat	Medeah	3	27·6	27·0
Millet	Siberian	2	40·2	46·9
Spring Rye	Saatroggen	3	30·4	33·6

The figures here presented in tabulated form show us that in nearly all cases the selected strains have given comparatively higher yields per acre than have the varieties. In some cases, this increase is very marked, and especially is this true in the case of Early Ripe oats, Dawson's Golden Chaff winter wheat and Siberian millet. Some of the new types are not only heavier yielders, but are also different from the original stock in other characteristics. These differences have probably been brought about through natural cross-fertilizations or through mutations in years past. Both our work and the results of the same correspond quite closely with those of Dr. Hjalmar Nilsson, of Svalöf, Sweden, and other noted plant breeders. To any one wishing to study more carefully the work of Nilsson, I would advise them to secure a book entitled: 'Plant Breeding' written by Hugo De Vries and published in 1907 by the Open Court Publishing Co., of Chicago.

OUR COMMON BARLEYS AND THE FIELD OPEN FOR THEIR IMPROVEMENT IN CANADA.

(A. P. MacVannell, B.S.A., Perth, Ont.)

It is true that very little work has been done in the way of improving and extending the cultivation of barley until quite recently. During the last ten years the growth of the live stock industry, the continually decreasing price and yield of wheat and the more general appreciation of the advantages of diversified crops have led to a marked increase in the acreage devoted to barley and a corresponding increase in the importance of this crop in Canada and the United States. Previous to the time when the United States placed the high tariff on barley entering that country, barley was the first money crop for the Ontario farmers and this had an effect upon the production in the province. Although this excessive duty imposed upon Ontario barley had the effect of decreasing the production, it also was a source of good in that the Ontario farmer later commenced to increase the acreage of barley and used it to feed the stock on the farm.

This increase in barley production has not been sudden or irregular, but has come naturally with the gradual and constant change in the conditions, and the indications point to a still greater increase in the near future. With the opening up and development of the West, we have a material increase in the production of barley, as a large number are going into the growing of brewing barley on a somewhat extensive scale. These farmers will count on barley and wheat as the main money crops.

With a continually increasing production and demand, however, more attention will be given to barley, and wherever it has received the same care and attention which has been given to other crops the results have been fully as profitable and satisfactory. There is no doubt whatever, but that barley can be successfully grown wherever any other of the cereals succeeds. Its importance compared with other crops cannot, at the present time, be estimated but its position among Canadian crops will become of greater value as the years go by. Those who have known barley the longest and best are the ones who esteem it most highly. In Great Britain few farmers who have once raised it or used it as a feed are satisfied to be without it. It is a recognized fact that wherever it has been attempted, an enlarged acreage is grown and an increased use is made of the crop. It is a peculiar fact that the barley crop, so old in agriculture, comes to so many at the beginning of the twentieth century, as one of the foremost crops.

HISTORY.

The early history of barley is very obscure but we have every reason to believe that it was cultivated for a longer period than any other cereal with the exception possibly of wheat. Both barley and wheat were cultivated long before we have any history of man. Barley has been grown for its grain for many hundred years. The ancient Egyptians, Assyrians and people about the Mediterranean grew barley for more than a thousand years before the Christian era. These people used it extensively as a food and for bread-making. They believed it to be exceptionally strengthening, consequently barley continued to be the chief bread plant of Europe until late in the sixteenth century, when the extensive cultivation of potatoes and wheat brought about its decline.

Although barley has been known in Egypt, Switzerland and China since pre-historic times, there is no authentic record as to what country it is indigenous. However, most botanists agree upon Southwestern Asia as the native home of barley. It is found growing wild there at the present time and it is upon this fact that scientists base their belief.

Barley was grown extensively in Great Britain and introduced into America (probably first into Nova Scotia), by the colonists about 1660. We have records of it growing in Virginia in 1611, at Lynn, Mass., in 1629, and that it formed the chief product of Rhode Island in 1726. Since that time it has spread rapidly over the entire North American continent.

The early centres of production in America were, as a matter of course, confined to the New England states. Later, we find the states of New York and Pennsylvania and the province of Ontario producing the largest quantities, while at the present time the middle western states and western Canada raise the bulk of the barley which finds its way into the markets. Although these districts are the great centres at the present time, every state in the United States and every province in Canada may be said to be a producer of barley. This fact alone shows that barley is a crop which is adapted to a variety of conditions.

USES OF BARLEY.

Ancient Egyptian history tells us that barley was one of the first grains to be used as a food for man. We are also told that it was one of the principal foods of the poorer classes until about 1600. Since that time it has been used more as a stock food. Barley has long been known as the 'brewer's grain' and is adapted to a variety of uses. It is known by this name because the brewers use it extensively in the manufacture of beer. The greater part of the barley grown throughout the world is used for this purpose. The same has been true since the earliest times. The grain is used also to a considerable extent as a feed for farm animals. In California and wherever oats cannot be successfully grown it is fed largely to horses and to a limited extent to cattle. In Ontario it is used largely for feeding hogs and cattle. A limited quantity is used for the manufacture of 'pearl barley' In America about one and one half million bushels are annually used for the production of pearl barley while considerably more is used in Europe.

Although barley is still used as a food, as a feed and as a fooder, its chief use is for malting purposes. The largest portion of the barley which finds its way to the different markets of America is used for malting. A liberal estimate is that eighty-five per cent of what is marketed is purchased by maltsters.

MARKETS AND MARKETING.

The main barley markets have usually been created by and dependent upon the malting and brewing interests. Until quite recently barley was thought to be of little value for anything but malting, but farmers have of late years been learning that it is one of our best feeds. As a consequence a new impetus has arisen from bringing and holding up the price of barley. Since barley has become more popular for feeding and its value for such recognized, more emphasis is being placed upon it for that purpose. We may expect to see barley valued according to its composition. There are, it is true, certain grades mentioned by some markets, but these do not mean anything as the malsters simply buy the barley as they think it is suitable for them.

The aim of the farmer should be to produce a barley which would meet the highest requirements of the market. He should at least thoroughly clean all barley and separate out all the damaged grain. Buyers for the malting trade pay little or no attention to samples containing any unsound grains. It would be more profitable for the farmer to retain such as is damaged at home for feeding to the stock as it only lowers the standard of the good grain. Besides, the farmer does not receive a price for the poorer grades which is commensurate with its value for feeding purposes. It is true that all maltsters do not agree as to the requirements in a brewing barley and this accounts for the lack of uniformity in grading. If care be exercised in the selection of the seed, and if the operations of sowing, harvesting, storing, threshing and cleaning, the market grade will be high.

VARIETIES.

There are two distinct types into which all barleys grown may be classed. These are the two-rowed and six-rowed groups. There is also another group—the four-rowed—but this is usually classed with the six-rowed as the latter often drops two rows midway down the spike. They are called the six-rowed and the two-rowed because of the way the kernels are arranged on the spike, the two-rowed with a row of kernels on either side of the rachis and the six-rowed having two rows of three kernels each. There are more than one hundred varieties of barley known and described by botanists. In America only four or five of these are grown generally, the farmers confining their attention to three or four of these to grow for use as malting material, feed and domestic consumption.

The suitability of these different varieties for the various uses has been the subject for discussion wherever barley is grown extensively. It is true that the two-rowed barley is grown very largely in Europe and is demanded by the maltsters. It has been questioned whether the European's preference for two-rowed barley is based upon the value of two-rowed barley for malting purposes. However, it does not follow that because the two-rowed is preferred in Europe it should be used in America. With few exceptions, the American brewer and maltster desires a barley of the six-rowed type. This may be explained in part, in the fact that in America large quantities of raw cereals are used in conjunction with the barley malt; the advantage of the six-rowed being that they contain, as a rule, higher per cent of nitrogen and are more able to convert the starch in the raw cereals and, containing a higher per cent of hull, provide a larger amount of filtering substance. One would generally suppose that the brewers would have some standard to guide them in the selection of a barley for malting. On the contrary there seems to be considerable difference of opinion as to what qualities really constitute a good brewing barley. Whether the barley should have a high or low protein content seems to be the main point around which they disagree. It is not my intention to enter into any discussion on this point. It is a matter for the brewers themselves to decide. Yet, I may say that from the records I have in my possession, the practical brewers and maltsters of the United States and Canada agree with Dr. Wahl, of Chicago, that the six-rowed varieties of barley are to be preferred for malting, under the existing conditions in America.

CHARACTERISTIC QUALITY.

As to the other qualities necessary, all are agreed that a good malting barley should consist of one species only, should be uniform in size and shape of kernel and should have a high germinating power—96-100. Its odour should be fresh; the sample should be free from blue kernels, foreign seeds and other material and should have a high bushel weight (48-50 pounds); the moisture content should be low; it should be free from smut, glass and flinty kernels and should have a medium sized husk of a light straw colour.

The impurity of barley seems to be its greatest defect for malting purposes. This does not at first though appear serious. But since the barley market is dependent in a large degree on the malting industry, its importance cannot be overlooked. It has been found that different varieties of barley require a different length of time to ferment or grow to the extent the malster desires. One variety may develop sufficiently in as short a time as four days while another variety, under identical conditions may require eight or nine days to reach the same stage. Under such circumstances the malster would have to discontinue the germination and the result would be that a part of the barley would have grown too much while another part would not be far enough advanced. In either case there is a heavy loss of the qualities sought for in the barley. Mould, bad flavour and innumerable other losses follow this condition.

The uniformity in size and shape of kernels which is so much desired may be obtained by exercising care in the production of the barley. A uniform sample can only be obtained by sowing well selected and uniform seed on well drained land that is all in the same state of fertility. The blue kernels can only be eliminated by growing pure races as these are a distinct type. Flinty and glassy kernels are a result of too quick ripening of the grain which may be caused by excessive heat just before it should ripen, but which is usually caused by cutting the barley when green. The grains do not ripen properly but become hard and transparent.

The proper odour of barley, a quality very much desired by the maltsters, is attained by allowing the barley to become thoroughly ripe before cutting, and giving careful attention to harvesting and storing. If the barley contains a high percentage of moisture, it will cause it to heat and, as a consequence, it assumes a musty and undesirable odour. Further, the moisture content may be so great as to cause the barley to grow, which renders it unfit for malting.

TIME OF CUTTING.

Farmers have been misled to a considerable extent by cutting their barley too early, believing that they would get a grain with a lighter colour. Although maltsters and feeders like to see a light coloured grain, they prefer a uniform and well-ripened kernel to a well-coloured, unripe one. Barley cut on the green side has a tendency to be flinty and glassy. This same characteristic is seen in the malt derived from flinty barley in that it lacks in colour and flavour. It is not necessary to have the barley perfectly coloured because the modern methods of cleaning and treating the barley before germinating are such that all but the very darkest kernels are made to take a clear straw colour. Ripe barley shows a higher germination than barley cut before it is fully ripe. Although it is desired to have the barley fully ripe before cutting there is also a danger of allowing it to become over-ripe as the grain is affected more after it has passed the ripe stage than at any other time.

The practice of threshing direct from the field should be condemned, because this practice has done more to lower the grade of barley than any other single factor. The barley has had no opportunity to go through the necessary sweating process when in the straw and will heat in the bin or storehouse. The result is that the grain is damaged, often to the extent of growing. Such barley as has become musty is entirely unfit for malting or pearling and is also less valuable for feed. It is not only the extent of the damage which causes the trouble but ever so small a quantity mixed with good barley will damage it. The musty odour is transmitted from the musty barley to the good and is likewise transmitted to the products made from such barley.

THRESHING.

Complaints are frequently made by brewers and maltsters of the injury done to barley in the process of threshing, owing to the fact that the cylinder and the concave of the threshing machine are set so close that many of the grains are cracked or broken. The presence of such injured grains greatly reduces the value of the barley as the broken, bruised or skinned grains often fail to germinate, and frequently show signs of moulding, thus leading to unsoundness in the malt and bad results in the brewery. This injury caused by overdressing is not limited to the grains which are actually broken. Grains closely nipped at one or both ends or such as have been bruised or peeled, are likewise objectionable. In fact, if by too vigorous threshing the husk of the barley is damaged, although the damage may not be apparent, irregularities in the malting are likely to result.

METHODS OF IMPROVEMENT.

As I said in the beginning, very little work has been accomplished by way of improving barley. This is due to the lack of certainty as to what is really required.

The need has been felt for a uniformity in grade and variety of barley and to accomplish this end the mixed and common varieties must be replaced by pure and distinct races. If we are to raise barley for malting this is the first improvement that should be brought about. The introduction and multiplication of varieties from other countries or by crossing, unless these have been carefully tried, only adds to the troubles already existing. There is ample room for the improvement with the best of the varieties we now have.

There is another way in which much improvement could be brought about and that is by having but a single variety of barley grown in each locality. At the present time, every section has a number of varieties and these are mixed at the elevators or in shipping. The experiment station of the state of Wisconsin has adopted the policy of breeding and testing pure races of barley and growing but a single variety in each district. These districts they call 'barley centres.' Each centre or county grows but one kind of barley and the maltsters of that and other states are willing to pay a higher price for Wisconsin grown barley on this account.

Mr. Léon Gérin.—Reference has been made previously to a work which gives an account of the Svalöf (Sweden) seed farm and laboratory. The author, M. J. Costantin, one of the staff of the Muséum d'Histoire Naturelle, Paris, France, summing up the data collected by his colleague, M. Blaringhem, while on a visit to Sweden, gives some interesting facts in regard to barley. These facts, as I understand, were brought to light at the Svalöf institute at the time it was under the management of Neergard, the predecessor of Nilsson.

Twelve varieties or sub-species of barley have been distinguished. Fundamentally, barley comprises three types: the hexastichum, or 6-rowed (of which the 4-rowed is considered to be a mere alteration or deformation) and the distichum, or 2-rowed, of which there are two varieties, the erect and the nodding. Thus we have three types to start with: the 6-rowed, the 2-rowed erect and the 2-rowed nodding.

If we put under the magnifying glass grains of any of these three types, we will find that some of the grains have smooth backs, while others have indentations or notches on the edges. On the other hand, at the base of the ventral or anterior portion of the grain, we will find that the plumule or tuft is, in some cases, made up of comparatively long, stiff, bristly hair, while in others it is made up of short and curled hair.

We have then four sub-species for each of the three foregoing types or species. That is to say, for the 6-rowed, for the 2-rowed erect and for the 2-rowed nodding, we have four different combinations: (1) Plumule of long, stiff hair, without notches on edge of back; (2) Plumule of long, stiff hair, notches on edge of back; (3) Plumule of short, curled hair, without notches on back; (4) Plumule of short, curled hair, notches on back. Altogether twelve sub-species.

It may be asked: What is the practical use of such distinctions? Well, it appears, in the first place, that these minor outside characteristics have a great permanency, and in the second place that they correspond to certain physiological characters or habits of life of the plant, such as rate of maturing. In other words, all varieties belonging to one of the aforesaid sub-species will, it appears, require approximately the same number of days to reach maturity, and evenness of maturity is of very great importance, not only from the point of view of the farmer but from that of the brewer and the baker.

In this connection, an inquiry naturally suggests itself: Are these minor features, linked as they are to fixed physiological characters and readily detected through a magnifying glass, revealed by the general outside appearance of the plant? It is an easy matter for even a careless observer to distinguish a 6-rowed barley from a 2-rowed, a 2-rowed nodding from a 2-rowed erect; but would it be possible with a little care, in going through a field of barley, to distinguish plants of any of the four sub-species

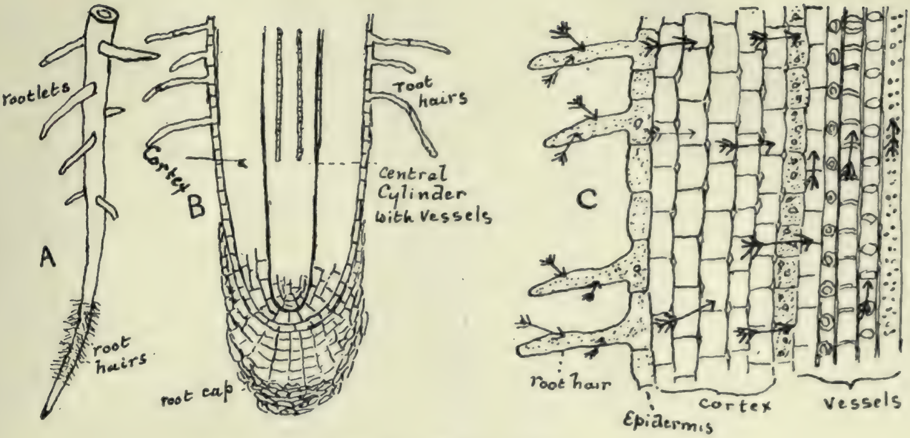


Fig. IX.—Structure of root.

A.—Root showing rootlets and root hairs.
B.—Tip of root showing root cap, central cylinder with vessels and root hairs.
C.—Showing how solutions enter the root hairs and pass through cortical cells into the vessels of central cylinder.

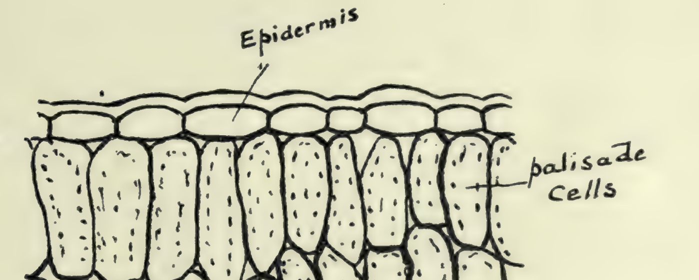


Fig. X.—Section through leaf of beet.

indicated above for each of the three types? From a conversation I had with Mr. Klinck, at Macdonald College, a few days ago, I infer that it would be practicable in a great many cases, and if so, there is here a wide, and to me unsuspected, field open for the hand-selection of seed grain, as henceforth the grower would be in a position to select from the standing plants in his seed plot specimens not only evincing the greatest productiveness and the most vigorous growth, but at the same time those showing those outward features indicative of physiological characters of the desired sort.

HOW PLANTS FEED.

(By Prof. W. Lochhead, Macdonald College, Que.)

The subject 'How Plants Feed' is one that has been treated over and over again in text-books of botany, horticulture and agricultural chemistry, and in popular bulletins and articles for the general reader. The reason for the introduction of this paper at this time is that the subject deals with a question that is of perennial interest on account of its relation to the growth and life of plants. Moreover, it is generally recognized that it is the duty of the intelligent plant-grower to acquaint himself as thoroughly as possible with the processes by which plants absorb, digest and assimilate their food.

It may be stated at the outset that there are many phases of plant nutrition that are not well understood to-day, in spite of the wonderful progress that has been made toward a correct understanding of the laws that regulate the life of plants.

THE PLANT IN ITS RELATION TO THE SOIL AND AIR.

The common higher land-plants, such as we ordinarily deal with, stand in vital relationship to the soil and the air. Their structure shows that they are specially adapted to this double environment. The roots which penetrate the soil are arranged so as to reach a large area of soil by means of their numerous fine branches. The tip of each rootlet is furnished with a large number of root-hairs which function as organs for absorbing water and the mineral salts dissolved in it. The fibres that give strength to each rootlet are collected near the core so as to resist most effectively the pulling strains exerted by the movement of the stem.

The stem acts as a supporter of the leaves, as a carrier of the solutions taken in by the roots to and from the leaves, and sometimes as a reservoir of manufactured food. The fibres that give strength to the stem are often arranged in the form of a hollow cylinder to resist most effectively the transverse strains to which the stems are continually subjected.

The leaves are specially related to the air and sunlight. They exhibit a broad surface to intercept the incident rays; they have special means for the exchange of gases; and they are the special factories for the conversion of crude sap into carbohydrates, such as sugars, starches, &c., fats and proteids.

The Absorption of Food Materials.—In this paper, I make a distinction between *food materials* and *food.* Mineral salts in solution and carbonic acid gas are food materials, but they are not food for the plant. It is well to bear this distinction in mind. One can observe this difference in the germinating plant. For the first few days it is feeding upon food stored up in the seed. It would starve, as animals would, if supplied only with water, mineral salts and carbonic acid. Moreover, certain plants such as fungi and other parasitic and saprophytic plants feed normally upon food such as carbohydrates and proteids, prepared for them by other green plants.

Plants get their raw food materials, from which they make food from the soil and the air. Many analyses of many plants and cultures in solution reveal the presence of carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus, iron calcium, potassium and magnesium as essential to the healthy green plant. Silicon, sodium and chlorine are usually present in most plants but their presence is not essential. With the exception of carbon, which is inhaled by the leaves as CO^2, the other essential elements are taken into the plant in solution as mineral salts. The root-hairs are the special organs of absorption. The process is termed *osmosis,* modified to a certain extent by the protoplasm within the living root-hair cell.

The root-hair is richer in organic substances than the soil is, hence there is a movement of water inwards leading to turgidity of the cells. The soil, on the other hand, contains mineral salts in solution, which are not present in any appreciable amount in the root-hair; and the result is that these mineral salts will pass in through the walls of the root-hairs, and in like manner, will pass from cell to cell until it is forced into the vessels of the wood, through which the solution can pass up to the leaves. (Fig. IX.)

At first all mineral salts in solution will pass into the root with equal freedom, but some will be utilized by the plant for the manufacture of food to a greater extent than others will be. There will come a time when certain solutions will pass in faster than others. In those cases where the salt is not used by the plant the cell sap will soon be as concentrated as the soil outside so far as that particular salt is concerned and none will enter the root-hair. This explains why a plant *selects* certain salts in preference to others.

The Work of the Leaf.—The leaf has very aptly been likened to a *mill,* with the sunlight as the *power* or *energy;* the living leaf-green cells the *machinery,* the crude sap and the carbonic acid the *raw materials,* the starch and other organic substances the *manufactured products,* and the oxygen and water vapour exhaled from the leaf the *waste products.* The presence of this mill is the distinguishing difference between plants and animals, so far as nutrition is concerned. Plants are organisms that make their own food out of the inorganic world about them. Animals are dependent upon plants for their supply of food.

The essential work of the leaf is the manufacture of carbohydrates; in fact the world's supply of carbohydrate depends upon the activity of the leaf. The leaf is structurally well adapted for the performance of its work. The delicate cells within are protected by specially thickened layers of cells above and below; just beneath the upper layer is a layer—*the palisade*—which absorbs the sunlight; the cells lying between the palisade layer and the lower protective layer are loosely joined together, so that there are many intercullar air spaces. In this spongy tissue the vessels and tubes of the veins of the leaf terminate; in the lower protective layer are numerous minute openings, the breathing pores or stomates, which allow of movement of gases in and out. In leaves of cereals, however, there is a departure from the type of leaf described. Stomates are found on both upper and lower surfaces, and the veinlets are surrounded by palisade cells. (Fig. X.)

The manufacture of carbohydrates takes place in the green cells, but the details of the process are not yet thoroughly understood. This much is known, however: *Sunlight* is necessary, the leaves must contain *chlorophyll* or leaf-green, the plants must be living, CO^2 must be present, a proper degree of temperature is required, and potassium must be present. Apparently the formation of carbohydrates is only carried on by those specialized bits of living stuff that contain the leaf-green, and is, therefore, essentially a vital process. After the CO^2 and water enter the green cells, they undergo chemical change, resulting in the formation of a soluble carbohydrate, and the liberation of free oxygen. The first stages of the making of carbohydrate are not clear, and I shall not trouble you with the disputed points. Although starch is the first *visible* product formed, it is now believed that glucose and fructose sugars are formed very early, and that these are converted into cane sugar and starch. In daylight the starch accumulates in the cells of the leaf, but at night when the *mill* is closed down, so far as the manufacture of carbohydrates is concerned, the starch and cane sugar are transformed by separate enzymes into maltose, glucose and fructose, which are carried from the leaf into and along the stem to the growing regions, and to special storage reservoirs in root, stem or seed. Cane sugar and starch must then be considered as temporary reserve or storage substances, since the first sugars formed are not carried away as fast as they are manufactured.

It may be noted here that starch is not formed in all leaves. There is none found in the onion, squill, many orchids, common milkweed, and other plants, and a small amount only in some gentians, irises and lobelias.

However, more complex substances than carbohydrates are formed in plants, the most important being amides and proteids. Amides contain C., H., O., and N., and are probably intermediate products from which proteids are constructed. Here again the various stages in the formation of proteids are not understood, so it will be unnecessary to deal with this phase of the question.

At any rate, we know that nitrogen is required, so that here the direct utilization of the soil salts brought up in solution takes place. Probably plants obtain most of their nitrogen from the nitrates of potassium, sodium, calcium and magnesium, and that an amide—the most common being asparagine—is formed from the sugars present. It is observed that asparagine is the form which most nitrogenous foods assume when in circulation, besides it is abundant as a reserve food in bulbs, tubers and roots.

The next advance is the formation of proteids from asparagine and sugars by the addition of sulphur and phosphorus, and here the compounds of these elements are utilized. Some of the proteids are soluble and are readily carried in circulation, but others are insoluble, wholly or partially. The latter must be converted into soluble forms before they can be carried from one part of the plant to another.

Protoplasm is a complex of proteids and is very unstable. By its own vital activities, one of which is known as *respiration,* it is continuously breaking down into simpler substances, first into proteids, then to amides, carbohydrates, and other products, some of which are useful, others useless. It is at the same time building up to repair the waste. When we remember that the entire skeleton of the plant, composed mainly of cellulose—a carbohydrate—is a product of the activity of protoplasm, and that perhaps most of the starch and sugar found in stored reservoirs in the roots, tubers, stems and seeds, are products of protoplasmic activity, we begin to realize how great is the activity of this complex living substance.

The processes of Respiration to which I have referred go on in every living cell of the plant—in the root, stem and leaf. In the cases of protoplasm and the nitrogenous substances the respiration process is a complicated one with many stages before the final product CO^2 and H^2O are reached. It is essentially an oxidation process, and if oxygen be excluded from a living cell the living substance of that cell will die. This explains why plants do not thrive in poorly drained soil where excess of water prevents the excess of oxygen or when seeds are buried too deeply they do not germinate, or at best, develop sickly plants.

The Circulation within the Plant.—All the higher plants are provided with special tissues for the rapid conduction of fluids. If we stand a cut leafy shoot of begonia, for example, in some water stained red with eosin or red ink for fifteen minutes or longer, we will find on examination that the red fluid has ascended the stem into the leaves; further, that the stain is confined to certain portions of the stem which we call the *fibro-vascular bundles*; further, that the stain is confined to certain parts of the bundle which we call the *Xylem vessels*, or the vessels of the wood. The special function of these vessels is, therefore, to conduct water and the soil salts in solution to the leaves. These vessels begin near the tips of the roots and end in the spongy tissue of the leaves. They lie outside of the fibro-vascular bundles and are supported and strengthened by thick-walled wood fibres. These conducting vessels are of two kinds: *tracheal tubes* and *tracheids.* Tracheal tubes are practically continuous tubes running from the rootlets to the leaves, while tracheids are elongated cells closed at the ends, but provided with numerous thin places on the walls, through which solutions can pass somewhat freely. The ultimate ending of veins in the leaves, and the conducting system of conifers are composed of tracheids. Although the tracheal tubes and tracheids conduct the raw materials from the root to the leaf, they also assist in conducting the food made in the leaf *upward* to the buds, in the spring.

To another portion of the fibro-vascular bundle, the sieve tubes of the bast, is assigned the task of conducting most of the food manufactured in the leaves to the growing points, to the living cells, and to the storage reservoirs in the root, stem and seed. The soluble proteids and sugars diffuse into the sieve tubes and the accompanying cells and pass along slowly upward and downward to the places requiring nourishment.

The sieve tubes are elongated cells with perforated end walls, and can be traced from the leaves to the rootlets. Where medullary rays are present some of the food is carried inward and outward into the cells of the medullary rays, some is removed by the *cambium* for the construction of new tissues, and some is passed on to the living cells of the cortex and other parts. It is sometimes not difficult to trace the path of the food in the sieve tubes by applying delicate tests for proteids, sugars and starches. (Fig. XI.)

Besides this specialized circulation by way of the vessels of the wood and the sieve tubes of the bast, there is probably a more or less diffuse circulation from cell to cell upward and downward in the cells of the cortex and elsewhere. The mineral solutions on entering the cortical cells of the root may pass slowly upward by diffusion from cell to cell. Some plants have the power to manufacture food stuffs in the green cells near the surface of the stem as well as in the green cells of the leaf. (Fig. XII.)

Again, some of the soluble foods in the cells of the leaf may pass slowly downward from cell to cell in the cortex, and nourish those parts directly.

The Role of the Mineral Nutrients.—As has been already stated, the manufacture of carbohydrates, amides and proteids demands carbon, hydrogen, oxygen, nitrogen, sulphur and phosphorus, as some or all of these enter into the composition of these substances and protoplasm itself. Let us examine for a moment the specific functions of the other essential ingredients in plant nutrition, viz.: *potassium, calcium magnesium* and *iron.*

Numerous experiments and observations tend to show that *Potassium* is necessary for the formation of starch, and in the polymerization of carbohydrates. Some experimenters assume that potassium has an influence on the osmotic power of plants, makes plants more resistant to freezing and produces colour in fruit.

Calcium is essential to the living cells of green plants, but unessential in fungi. Moreover, it has been observed that calcium accumulates in leaves when starch formation is going on, and is associated with starch transfer.

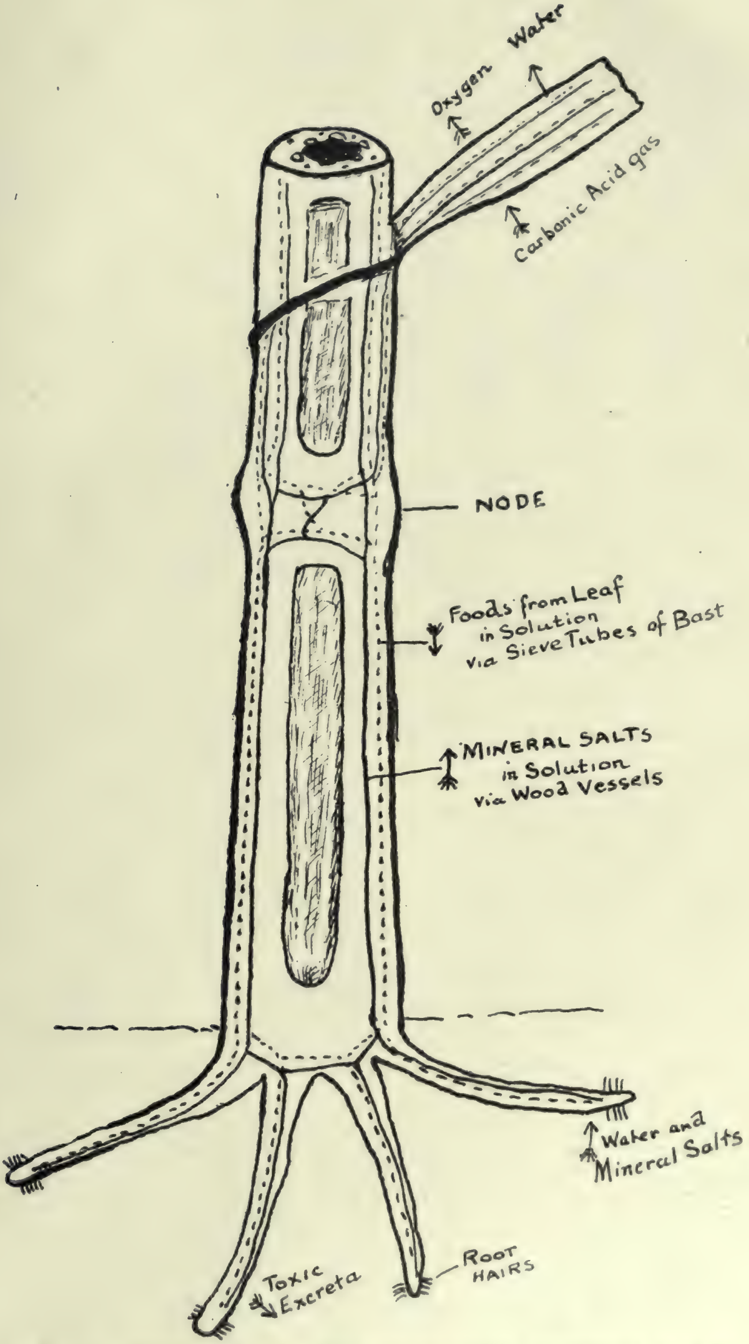
Magnesium is essential to the assimilation of phosphorus, and in its absence oil is not formed. It is always present in chlorophyll.

Iron is essential as chlorophyll cannot be formed in its absence, and it may be that it is one of the essential components of protoplasm, since it is claimed that fungi which have no chlorophyll cannot do without iron.

Toxic Excreta and Mineral Nutrients.—The discussion of this topic is now a live one with agricultural chemists and plant physiologists, as current literature shows. One side maintains that even the best soil becomes exhausted of available plant food materials after a certain number of crops have been removed from it, and that it is necessary to replace the lost mineral nutrients by the addition of fertilizers in one form or another. For example, Dr. Hopkins, of Illinois, states that a thousand years of cropping on the average prairie and upland timber soils of Illinois would require every pound of phosphorus in the soil to a depth of ten feet. There is a limit therefore, to the amount of essential mineral nutrients in the soil, and that in time there must be exhaustion if nothing be added.

The other side, championed by the U. S. Bureau of Soils, contends that 'the fertility of the soil can be maintained by arranging a system of rotation and growing each year a crop that is not injured by the excreta of the preceding crop;' 'unproductiveness arises from the presence in soils of the waste products of plants,' and that 'fertilizer salts can bring about or aid in the destruction of toxic organic substances.'

The soil, it is contended further, is not the product of the *decomposition* of the



Oxygen
Water
Carbonic Acid gas
NODE
Foods from Leaf in Solution via Sieve Tubes of Bast
MINERAL SALTS in Solution via Wood Vessels
Water and Mineral Salts
Root HAIRS
Toxic Excreta

Fig. XI.—Diagram of a rye plant to show the upward movement of crude sap through the vessels of the wood, and the general downward movement of food solutions from leaves through sieve tubes of the bast.

rock, but rather 'is an *unconsolidated rock* containing the minerals which were present in the solid rock from which it was derived, together with more or less decomposition products.' These mineral ingredients are appreciably soluble, and 'the composition and concentration of the soil moisture, the nutrient solution, is the same in all soil solutions. All soils contain sufficient plant food for the support of plants; and when the plant takes into its substance some of the mineral matter from the solution, the solid minerals in contact with the solution immediately dissolve, and the solution is restored to its former concentration. The exhaustion of the soil, therefore, is merely a relative phrase and resolves itself into the question of the *rate at which the solution can recover itself*. This rate is as fast on an acre planted in our ordinary crops as the demand made upon it by the plant.'

As is usual in controversial cases there is much to be said for both sides. It is probable that when the discussion is closed it will be found that both sides were right on many points, and that both sides have contributed much to the solution of the problem of fertilizers. It is undoubtedly true that plants excrete certain waste products, but the exact nature of those products is not understood. That some of them are toxic to the plants excreting them or to other plants has been the belief of some botanists for many years, and many instances can be cited when the presence of a certain plant inhibits the growth of another plant beside it. Dr. Schreiner, of the U. S. Bureau of soils has actually isolated some of these toxic organic compounds from the soil, and is confident that they have been excreted by the plant and not by organisms in the soil. Moreover, he has shown that very minute quantities of this poisonous excretion are sufficient to inhibit the growth of certain plants.

The Bureau of Soils has also proved that a certain inert substance of no fertilizing value, like carbon black, may produce in certain cases an improvement equal to that of a standard fertilizer, and that the toxic substances can be destroyed or rendered harmless in various ways:—

(1.) By the use of certain fertilizers, such as sodium nitrate, stable manure, green manure, whose beneficial effects are in large part due to their action on the soil constituents rather than to the salts carried into the soil.

(2.) By 'methods of cultivation which promote the aeration of the soil and the growth of micro-organisms that aid in destroying deleterious organic substances;'

(3.) By proper and systematic crop rotation in which a crop is not injured by the excreta of the preceding crop;

(4.) By treatment with absorbing agents such as carbon black;

(5.) By the oxidizing powers of the roots themselves combined with substances ordinarily used as fertilizers.

It is claimed moreover, that chemical analyses of fertilizers are of little value for correcting the difficulties of the soil and rendering them productive, because a fertilizer that improves one soil may not improve another.

Some of the questions under discussion which are not convincingly answered by the Bureau of Soils are these:—

1. Are the different soil solutions found in all kinds of soils in every part of the country of the *same* composition and concentration with regard to phosphoric acid, potash and nitrates? We know, for example, that waters are *soft* in one region and *hard* in another, thus making a difference in composition, in this respect at least.

2. Is not a considerable amount of the soil solution lost by leaching and run-off? This must happen, one would think, in sandy soils which have very little retentive power.

3. Will the soil solution recover its normal concentration and composition as fast as the plant disturbs it? Is a soil solution ever saturated ?

4. Is there any need of introducing nitrogen to the soil to replace that taken out of it by a crop? Or, is it possible to keep up the fertility of the soil, without the introduction of a clover crop in the rotation, or the use of nitrate or barnyard fertilizers?

5. What is the true function of humus in the soil?

6. If humus is the stable inert substance that the Bureau of Soils claims it to be, why does the dark colour of the soil disappear gradually under successive cropping?

The majority of agricultural chemists believe, I think, that the amount of food materials in the soil 'depends partly on the kind of rock from which it has been derived, partly on its 'fixing' power and partly on the kind and quantity of plants which grow upon it.' They believe also that each kind of soil has its own proportions of the different plant nutrients, and that each kind of crop has its own special requirements of food materials. A cereal crop will take from the soil about one-fourth as much potash and about one-half as much nitrogen as a root crop. It would seem, therefore, that the element, whether it be phosporus, nitrogen or potassium 'of which there is relatively the least, determines the productive power of the soil.' A deep-rooted plant, like clover, gathers its food materials from a level which a wheat plant, for example, cannot penetrate, hence the practice of alternating deep-rooted crops with shallow-rooted crops in a rotation. Leguminous plants have the power of converting the inert nitrogen of the air into available nitrogen through the action of the bacteria on the root tubercles, thus adding very materially to the quantity of available nitrates in the soil. Moreover, it is believed by most chemists that one of the main functions of fertilizers is to aid to the available food nutrients of the soil.

Upon these and other matters the two sides take issue. The discussion is more than academic, for the ultimate result is of great importance. By a wrong system of soil treatment, we may hand down to posterity an impoverished soil which may not be able to support the demands of a greatly increased population. Scientific agriculture means the growing of large crops and the conservation, even the increase, of the fertility of the land. One side maintains that not less than thirty-three million dollars is wasted annually in the United States on fertilizers, largely because a fertilizer can do little good unless the soil happens to possesss toxic substances for which the fertilizer *might* be a remedy. The present method of application of fertilizers is a *hit and miss* with the odds in favour of the latter.

Conclusion.—It will be observed that while we know considerable about the mechanics of circulation of food materials and foods within the plant, there are yet many matters about which we are in great ignorance, both as to the chemistry of the building up and the breaking down of the organic compounds, and the chemistry of the soil. However, with so many workers in these fields of investigation, and with a better knowledge of organic compounds it is more than likely that all these different matters will be made clear in the near future.

THE SEED PLOT AS AN EDUCATOR.

(By J. W. Gibson, M.A., Ottawa, Ont.)

Just how much the boys and girls of the provinces of Canada had to do with the origin of the Canadian Seed Growers' Association I am not prepared to say, but I believe that their work under the Macdonald-Robertson seed selecting and growing competition carried on some years ago, not only provided tangible evidence of the great possibilities of improvement of grain crops by systematic selection, but also gave to the worthy promoters of the competition that inspiration that springs from a worthy work valuable alike to the home and to the school, carried on by eager, bright-eyed boys and girls, the men and women of to-morrow.

And so I am here this afternoon to discuss with you, from the school boy's standpoint, the educational value of the seed plot and of seed growing generally, hoping that this Association will continue to recognize that well cultivated farms must be preceded by well cultivated farmers and that the boys now attending our rural public schools and academies, throughout the length and breadth of this broad Dominion, if

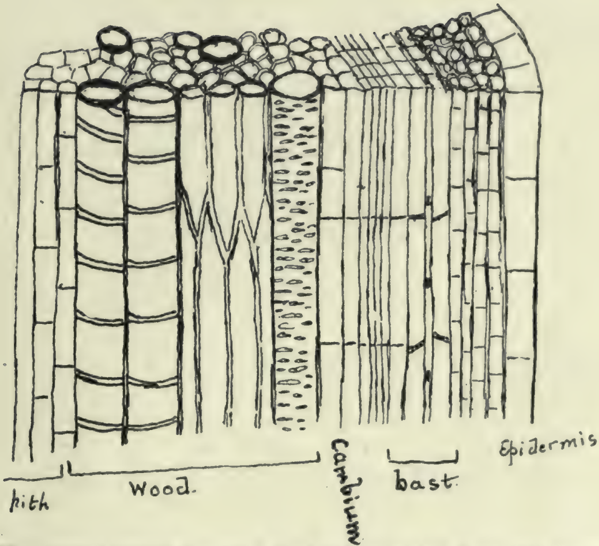


Fig. XII.—Radial section through a dicotyledonous stem from pith to epidermis.

properly trained, will eventually become a mighty force in directing and establishing our industrial and more especially our agricultural supremacy.

Most of what I have to say on this subject is based upon my experiences of the last five or six years as a travelling instructor in Nature Study and School Gardening.

The cultivation of useful and beautiful plants has always been associated with the highest and best civilization. The possibilities are very great from the standpoint of the producer as well as from the standpoint of the product. To the school boy who tends his little plot of seedlings in home or school garden as well as to the professional seed grower who watches his teeming acres with practised eye, Nature holds out a beckoning hand. She offers to each a prize for intelligence and industry suited to his station. She is no respecter of persons or ages; she has secrets for those who woo her, health and prosperity for those who respect her laws and rich reward for every toiler in her realm. The successful horticulturist or seed grower must be a close student of Nature. He must have a keen and discerning eye, ever on the alert for signs of good or ill, and with a mind trained in interpreting the facts and phenomena associated with living things. He must have a mind that is open to conviction and to new truth and if he would go far he must not be too eager for gain. His work should first be interesting, afterwards it may become profitable. Principal Felmley, of the Illinois State Normal School takes the right point of view when he says: 'If the farmer as he trudges down the corn rows under the June sun sees only clods, and weeds, and corn, he leads an empty and a barren life. But if he knows of the work of the moisture in air and soil, of the use of air to root and leaf, of the mysterious chemistry of the sunbeam, of the vital forces in the growing plant, of the bacteria in the soil liberating its elements of fertility; if he sees the relation of all those natural forces to his own work; if he can follow his crop to the market, to foreign lands, to the mill, to the oven and the table; if he knows of the hundreds of commercial products obtained from his corn or the animals that it fattens; he then realizes that he is no mere toiler; he is marshalling the hosts of the universe, and upon the skill of his generalship depends the life of nations.'

And, Mr. Chairman, I have no hesitation in saying that this same acuteness of observation, this keeness of perception and discrimination which is developed to some degree in every boy or girl who carefully and thoughtfully plants a seed and rears a plant to maturity, and to a greater degree in every farmer and seed grower who by his larger enterprise has placed upon the market improved selected seed in quantity, is also made manifest in other affairs of life. The daily questions that arise in political, social or commercial life will be held up to the same keen scrutiny by such men and unerring conclusions arrived at.

To the immature but inquiring mind of the school boy a perfect wonderland of natural science is opened up wherein he makes his own observations, draws his own conclusions or constructs his own theories. On one occasion, I came upon a little chap of 9 years, who was pulling weeds from his plot in the school garden. I asked him why he wanted the weeds out. His reply was that they stole the food from the good plants. 'What food do you mean? I asked. 'Oh' said he, 'you know the roots take up food for the plant from the soil and when it comes up into the leaves the sun shines on it and cooks it.' Here was a budding scientist who was more nearly right than wrong and who may some day set the world athinking.

Seed planting is one of the most delightful of exercises. It comes at that time of year when all nature is tingling with new stirring life and the promise of things hoped for. It is an act of purest faith and cannot but have a beneficial influence on the character of the sower. It is a theme that has touched alike the artist and the poet. Listen to the master-piece of our own Canadian Roberts:—

' A brown, sad coloured hillside, where the soil,
Fresh from the frequent harrow, deep and fine,
Lies bare; no break in the remote skyline,
Save where a flock of pigeons streams aloft,

Startled from feed in some low-lying croft,
Or far-off spires with yellow of sunset shine;
And here the sower, unwittingly divine,
Exerts the silent forethoughts of his toil.
Alone he treads the glebe, his measured stride,
Dumb in the yielding soil; and though small joy
Dwell in his heavy face, as spreads the blind,
Pale grain from his dispensing palm aside,
The plodding churl grows great in his employ;
Godlike, he makes provision for mankind.'

And surely such a noble occupation as this where man, 'unwittingly divine' may become a co-worker with his Creator in 'making provision for mankind' in ever increasing measure, should have an enobling influence on all—both old and young—who take part in it. And it has. There is an education of the heart as well as of the mind. In our schools it has as yet been but dimly recognized; but new light is breaking here and there—the dawning, let us hope, of a new era. When it comes more time will be devoted in our schools to the training of the children through their own purpose—full activites, in the study of Nature, in the cultivation of the soil and in the manual arts and less to the dull routine of tasks assigned from books.

The enthusiasm of a young apprentice gardener and seed grower is delightful. He finds himself in possession of a plot of ground. There are great possibilities in store for him. In large measure the responsibility for success or failure rests with himself. He is no longer the ungoverned and irresponsible urchin, but instead the responsible member of society; the honourable citizen of a miniature commonwealth. This feeling of conscious power seems to be inherent in all who cultivate the soil. Self reliant, and possessed of a sturdy independence and mastery, the husbandman goes unerringly about his task of subduing the earth. This spirit of responsible and capable manhood, of fearlessness and noble enterprise has always characterized to a degree the tiller of the soil, and no greater good can be conserved to the boys of our young and growing country, than to provide for them the opportunity of gaining that Antaean strength which only the touch with mother earth can give. The boy with his plot of ground—the size of either being but a matter of time and space—becomes a producer as well as a consumer and he revels in his newly acquired power. By nature he may have been destructive in his tendencies, but now his work is essentially constructive, and when it reaches its full development the markets of the world will proclaim it by the greatness and excellence of their added stores.

The economic and commercial aspects of seed-growing undoubtedly occupy the most prominent place in the minds of the seed growers before me, and quite properly so; but with the young seed growers with whom it has been my privilege to work, it is and should be otherwise. I do recall, however, one instance where a little fellow had planted a row of fine wax beans with the most scrupulous care and with much anxiety too, as to when they might be 'up.' Returning to his plot on Monday morning he was greeted by a pretty row of healthy looking seedlings and his delight knew no bounds. Rushing in to his teacher he exclaimed: 'Oh Miss W. . . ., my beans are up and they have got beans on them already.'

The seed plot lends itself to a great variety of researches and experimentation. It affords to the school boy admirable opportunity to study the complete life of a plant. Such a study includes germination of the seed and real viability tests. Such tests may be carried on under laboratory conditions at the same time, but of the two the former is of the greater importance. We are concerned chiefly with the percentage of seed that will grow and produce strong plants under the varying conditions of the out of doors laboratory. One of the great values that such work affords is the training in thoroughness and accuracy of observation, and the keeping of reliable records from year to year. Every important detail should be noted, and the date given. Every gardener and seed grower should keep a diary. In this should be noted such points as name of variety of seed planted, where obtained, price paid, nature of soil and climate where produced, percentage vitality, time required for germination under given conditions, results from planting at different depths and at different distances apart, rapidity of growth under given conditions of soil, moisture and heat, length and strength of straw, habit of growth quality and quantity of the yield, weight per bushel, immunity or susceptibility to rust or blight, how disposed of and price realized. All of this and more can be ascertained by every painstaking person in possession of a seed plot. In the doing of it the eye is trained to detect minute differences and the mind to appreciate their significance and to weigh all conditions present. Manual dexterity and skill are developed in the performance of the whole work, the scientific spirit is awakened and the whole life is enlarged and intensified.

In studying the life of the plant one must include its whole environment. This will naturally include first of all the soil in which the plant grows, what its composition is, its organic and inorganic content, its texture on which depends in large measure its moisture holding properties, the substratum and source of water supply, its drainage facilities, the plant foods in which it may be lacking and the most suitable fertilizers. The influence of climatic conditions upon the plant should also have consideration. These have to do with mean and extreme temperature during the growing season, intensity and duration of sunshine, humidity and rain-fall and lastly wind.

It is a painful fact that the insect enemies and diseases of garden, orchard and field crops are steadily increasing in this country and so also in this connection the seed plot affords a wide field for observation and research. The successful farmer and seed grower of the future must be a practical biologist. He must know something of entomology and bacteriology as well as of botany. For some years our more advanced schools and colleges have offered courses in these important branches of science, but they have been cutting their cloth at random, they have never stopped to measure their man, they are not sufficiently in touch with the life and work of the people. In connection with the school-garden plots, I have found the boys much interested in the insect and animal life so frequently present in abundance and variety. Their respect for our common toad, for example, has been increased. On one occasion I spoke to a class of boys of the value of this unobtrusive, but industrious insect destroyer, to every gardener. One boy suggested that he might bring some toads. and although his mates rather treated the proposition as a joke, I made him the offer as a guarantee of good faith on my part, that I would pay him five cents each for toads. To my surprise and to my delight I found on my return the following week that he had taken me up. Along he came with face beaming with pleasure and a boot-box fitted with a perforated lid under his arm. 'Hallo Jimmy,' said I, 'what have you in the box?' 'Toads' he promptly answered. 'Good,' said I, 'how many?' 'Fifteen,' and his eyes glistened with excitement. 'Let them out,' said I, and Jimmy walked over beside his own plot and uncovered the box, when to the amusement of us all the imprisoned throng hopped or scrambled out and were soon safely hidden amongst the plants or in the soft dry earth. I paid for those toads, but the money was really invested in a fine and promising boy and it would not be hard for me to prove to you that it was a good investment.

The number and variety of studies and tests that can be carried on in seed plots is almost unlimited. Some of those which the school have taken part in have been of interest and profit to parents as well as pupils. New varieties of grains and vegetables are constantly appearing upon the markets. Some of these can be tested every year and their suitability to the soil and climatic conditions shown. Visitors to the seed plots learn much from these variety tests and may be saved much expense and disappointment by thus having seen them or on the other hand may discover varieties of great merit and special adaptability.

The superiority of crops grown from selected seed over those grown from ordinary or poor seed of the same variety has been a revelation to the world. It is in this most valuable work perhaps more than in any other, that the Canadian Seed Growers have excelled and are fast winning a world wide reputation. We may not all agree as to the permanency of improvements effected by the systematic selection of seed. The breeders and specialists may strive after short cuts and novelties through mutation and hybridization and whilst we wish them all success in their most interesting researches, the fact remains that for most of us, success is conditioned by careful cultivation and judicious selection. The seed plot is helping to solve the fertilizer problem, which is one of the most difficult of solution. The nature of the fertilizer best suited to the soil and to the crop to be grown, can be readily verified by using a series of small seed plots. Here too the question of cultivation comes in for consideration in making available for the plants, what nature has already provided. In the seed plots of the school gardens we have given a good deal of prominence to the growing of clovers and during the past season a few of the schools included experiments with inoculated seed and not without a measure of success although the management of the cultures requires considerable care and skill in handling. The seed plot provides an interesting and valuable study of closely related plants. A single plot may contain a number of varieties or strains of the same species or a number of species belonging to the same family. For example a plot might be divided up into ten rows containing each one of the following species of the Cruciferae: Turnip, radish, mustard, shepherd's purse, cabbage, rape, garden cress, candy-tuft, sweet alyssum and stocks. These may be planted by number, the names being withheld, and a contest carried on in the naming of them as soon as possible after coming up. The similarity in the internal qualities of these species as well as in external resemblances may be further shown by the fact that all suffer from the attacks of the Striped Flea-Beetle. Another valuable plot contest is that which is afforded by planting a series of rows using a dozen varieties of weed seeds. On coming up many of these weed seedlings are not easy to distinguish from the seedlings of our economic plants and the value of such an exercise in identification is too obvious to need further comment. The principles and practice of the rotation of crops should also be carried out in these educational plots.

Lastly one of the most valuable or instructive lines of work carried on in our seed plots was the cultivation of potatoes. The use of fungicides and insecticides was here introduced with almost phenomenal results. In each of the gardens our potato plots were side by side, all conditions of soil, cultivation and fertilization being as nearly alike as possible. The yield, both as to quality and quantity, from the plots sprayed with Bordeaux mixture was greatly increased. The increase in the gross yield varied from 27 to 45 per cent, and in marketable tubers from 73 to 130 per cent. There was a decrease in small tubers as a result of spraying of from 25 to 68 per cent and of rotten tubers from 75 to 83 per cent. The best yield obtained in school garden plots was 710 bushels per acre on a plot of 1/200 of an acre in area.

Last Spring (1908) through the liberality of a few of the leading men in Ottawa and the surrounding country, I was able to offer prizes to the boys and girls in the school gardens of Carleton County in potato growing and flower growing respectively. Each boy or girl entering the contest kept a daily record of all work done and of current observations. The following is a fair sample and from it one may form some idea of the benefits derived by this young gardener, from his management of a seed plot in a school garden.

'The soil in our school garden is a very heavy clay on the eastern side, while the western side is loamy. It is very stony and has any amount of Scutch grass, but I cleaned most of that when digging, hoeing and raking. The soil was very heavy, dry and lumpy therefore it was hard to work it up.

'May 26.—I dug my plot with a potato fork about 1 foot deep and accordingly as I dug it I picked off the Scutch grass.

'May 27.—A heavy rain after my digging and then the sun came out hot and caked up the ground. I then took my hoe and hoed it and cut it up fine and loose.

'May 28.—I raked all the stones I could see off my plot to-day and threw them in a pile and then got the wheel-barrow and wheeled them away, after this I levelled my paths and left it for another day.

'May 29.—First thing I did to-day was to measure off my plot in hills. They are 3 ft. by 2½ ft. apart. Then I planted my potatoes and put about two inches of soil over them. My plot is 23 feet 8 inches long and 11 feet 7 inches wide and the number of hills is 60. The potatoes I planted were called the 'Rural New Yorker.' The seed I planted weighed four pounds. I cut the potatoes so that there would be two or three eyes in each piece. They are a pretty late potato but a very fine potato when grown right. We grow them at home and find that they are the best potato going. The skin is smooth and eyes shallow. The potato will speak for itself, for it is a fine, round, plump one. The weather has affected my plot as it was dry all summer and there was no nourishment in the ground for them.

'June 9.—To-day I noticed my potatoes coming up. When they start coming up and when quite near the surface they seem to lift the soil that is over them and gradually throw it off as they come up. They have been exactly eleven days coming up.

'June 15.—This is the first day I cultivated my potatoes. They were not all up, but I hoed between the lines to kill the weeds.

'June 21.—To-day was the first I saw potato bugs, but not very many and I picked them off and killed them.

'June 22.—The potato bugs have been increasing rapidly. One reason is I killed the bugs on my potatoes and the other boys did'nt and they came off their plots into mine for I saw them. I hoed my potatoes and raked them. They were all up in fine condition.

'June 30.—To-day I hilled my potatoes with a hoe. There was'nt a bug on them to-day.

'July 4.—To-day was the first day I sprayed my plot with Paris Green. The dose was 1½ teaspoons to a can of water. If you put it on too strong it burns the potato tops and hurts them.

'July 22.—I sprayed my plot to-day with Bordeaux mixture and added a little Paris Green to kill the bugs. I put the Bordeaux mixture on for potato diseases such as blight, rotten tubers, etc. It is a good medicine for potatoes, yes, one of the best. The way I made the mixture was ¼ of a pound of copper sulphate to ¼ of a pound of lime to 2½ gallons of water and then tested it with a little strip of blue paper. I hilled my potatoes for the last time this year. They grew very slowly because of the dry weather. I noticed that the number of eyes I left in the potatoes that was the number of stalks that came up.

'September 17.—I dug my potatoes to-day and had three patent pailfuls. I threw the stalks in a pile in the corner of the plot. I weighed the potatoes and saw they were balanced right and on the level. They weighed forty-four pounds out of 52 hills for there were 8 hills pulled by some one when I went back to school and if you wish you can add something on, that is if you think right. There was not a rotten one on the plot. The number of pounds to the acre would be 200 x 44, 8,800 pounds or 146⅔ bushels. The potatoes are fine in quality and as big as large goose eggs and of a fine shape.'

After doing this work the boy had still time enough to help his father on the farm and to do the work required for Entrance Examination to High and Continuation schools on which he took a high standing. And so it is that many a boy has been made more manly and self respecting, more thoughtful and reverential, more helpful to his fellows and of greater value to the state, because of his having been led at an early age to take part in this highly educational and beneficial department of the world's work. Such boys will leave the world a little better than they found it.

'Give men their gold, and knaves their power,
Let fortune's bubbles rises and fall.
Who plows a field, or trains a flower,
Or plants a tree, is more than all;
For he who blesses most is blessed,
And God and man will own his worth,
Who seeks to leave at his bequest
An added beauty to the earth.'

PAPERS PRESENTED BY MEMBERS OF THE ASSOCIATION ON THE OCCASION OF THE FOURTH ANNUAL MEETING OF MEMBERS IN THE MARITIME DISTRICT, AMHERST, N.S., DEC. 2, 1908.

Some Essentials for Success in Seed Growing.

By J. R. Oastler, B.S.A., Minister's Island, N.B.

Successful seed growing depends primarily upon three conditions: a favourable soil, good vigorous seed and favourable weather conditions. The first two conditions are directly under the control of the seed grower and where the soil is favourable and good seed is used, even in unfavourable seasons, an average crop is often realized.

In farm practice in our district I have found it to be absolutely essential that we follow a rotation of crops in which clover occupies a prominent place. It may be asked: 'What connection has rotation of crops with successful seed growing? In reply, it may be explained that very few farmers are situated so that they can make a success of one special branch of farm operations such as seed growing, without barnyard manure and the humus obtained from clover and grass sod. Without the check to weeds, which is given by crop rotation, we would find that our soil was becoming each year more unsuitable for the growing of seed grain, and our chance of winning our goal more remote. The different farm operations so dove-tail into each other that we cannot afford to neglect any one of them. Every farmer should have some special product however, in which he takes great pride and makes it the distinguishing feature of his farm. It is the successful farmer who so balances his various farm operations that they help him to carry to a successful issue his main feature.

I usually sow oats on sod which is ploughed the previous fall as soon as possible after haying. A couple of weeks after ploughing it is thoroughly disced and in the spring as soon as the land is sufficiently dry it is given a couple of strokes of the harrow. I firmly believe there is urgent need for improving the fields on many of our maritime farms; many of the old fences should be removed, old stone piles, rocks, stumps, bushes and other movable obstructions should be cleared off, so that we can use modern machinery to advantage. By using one and two-horse teams instead of four and six we are adding to the cost of labour.

The second season we cultivate part of the fields for corn, roots and potatoes, and the remainder is seeded down again either with barley or black oats for a nurse crop.

Formerly I was strongly in favour of ploughing stubble land in the fall, but on our farms here there are only certain fields where we can plough to advantage; on side hills the soil washes badly and on land which is rather low and late the ground requires to be ploughed again in the spring. By letting the soil lay a week before sowing a chance is given the weed seeds to sprout and by giving a thorough harrowing when sowing, these weeds are killed and the grain gets a fair chance. It is very important to sow the oats as soon as the ground is in condition.

When in Ontario and Manitoba it was my practice to sow oats at the rate of about two bushels per acre, but in our district in New Brunswick, I was advised that if I sowed less than four bushels I would have a crop failure. Under certain conditions this is correct.

There is a great difference in the stooling qualities of oats, the Banner for instance being much superior to some other varieties such as the Storm King in this regard. I may state that the broad-cast seeder is used most commonly, but I believe we would get fully as thick a stand of grain if we were to use a press or a disc drill and sow at the rate of three bushels per acre.

In regard to harvesting I like to have the grain as ripe as possible before cutting, especially if a self-binder is being used. I may add, however, that it is much more difficult to get grain harvested in good condition on the sea shore than it is inland where heavy dews are not so common. In regard to cleaning and sorting the grain we should make greater use of the fanning mill in these provinces. In too many instances the seed grain is simply taken in the condition in which it comes from the threshing machine, and I am therefore not surprised to find many farmers saying that they have to sow oats at the rate of 4½ bushels per acre.

Oats and barley are, I believe, the two most suitable grain crops for these provinces. They are the most reliable and are the most suitable for the feeding of our live stock. Incidentally one of the greatest aids to successful grain growing would be the keeping of more and better live stock on our farms.

The success of the Seed Growers' Association will ultimately depend upon the commercial advantages which the members will enjoy as a result of special seed selection. Time does not permit our going into details, but I have certainly found it to pay from a commercial standpoint, and besides this there is, I find, a growing satisfaction and interest on my part in the work of seed selection.

SELECTION OF SEED POTATOES.

By Harry R. Brown, Wallace Bay, N.S.

The question of potato culture is always one of considerable interest. With a history dating back but some 300 years, the potato has attained a position on the bill of fare of the human race unequalled by any other single agricultural plant.

A native of the high lying lands of Chili, it was introduced from there into Spain and North America. The potatoes grown in America to-day have probably come from three main stocks: First, from stock taken from America to Ireland about 1586, by Sir Walter Raleigh, or some of his colonists; second, from stock introduced into Europe by the Spaniards a few years earlier and, third, from stock used by the first American settlers who doubtless obtained their supply of seed from the natives.

Cosmopolitan in character it is one of the most extensively grown crops rivalling in popularity the king of crops, wheat; and indeed, the world's potato crop exceeds the world's wheat crop by about a billion bushels. This popularity is mainly due to two principal causes: First, the wide area over which it can be grown sucessfully. It succeeds well in every habitable part of Canada from the little 'Garden of the Gulf' on the Atlantic Coast, to northern Yukon. A prominent Prince Edward Island divine, who spent a number of years in the Yukon, said not long ago: 'Though I come from the Island they call in the North 'Spud Island' yet I have never seen anywhere else, such potatoes as they grow in Dawson City.' Indeed, given suitable cultivation, it may be grown on a wider range of soils, and under a wider range of climatic conditions and temperatures than perhaps any other crop. Secondly, its palatability and cheapness as a food—like bread it is equally indispensable to rich and poor, and is an article of which we never tire. But, not only as food, are potatoes popular, for they are now converted into two very important articles of commerce, namely starch and alcohol. The latter used for motive power and lighting, but also, unfortunately, frequently converted by a subtle process of alchemy, into 'Fine Old Highland Malt Whiskey.' Europe devotes 40 per cent of her entire crop of about 3,844,991,000 bushels, to the manufacture of these two commodities.

The demand for potatoes is great. The city of Toronto alone consumes daily from 3,000 to 4,500 bushels. Of this amount she draws 80 per cent, for nine months of the year, from the maritime provinces.

Taking the importance of the potato crop for granted, let us look to its improvement. When we consider that a return of 300 bushels per acre is common, and that yields of 400 and 500 bushels are not at all unknown, the average yield per acre for the Dominion of Canada of 123·37 bushels—35 bushels greater than that of the United States—seems ridiculously small.

While we have no means of comparing the yield per acre of to-day with that of 300 years ago, we know that the potato has increased immensely in size. A noted French botanist in describing the potato in 1601, stated that one tuber yielded as many as fifty tubers of unequal size, from one to two inches long, irregularly ovoid and reddish. A potato two inches long would weigh probably about one and one-half ounces. To-day tubers weighing one pound are not uncommon and I have read of one weighing as much as six pounds. This improvement has been brought about largely through selection and a still further improvement can be made by the same means. But we must have a system for selecting. An examination of the individual tuber alone will not enable us to judge whether or not it inherits vigour and productiveness; selecting large or medium-sized tubers from the bin will not, with any degree of certainty, ensure a better crop, as these may have come from hills in which the majority of the tubers were of an undesirable type. Generally speaking, since the inherited tendency of the potato is to reproduce not its own individual characteristics, but rather those peculiar to the plant or strain from which it comes, it is very evident that even a small tuber from a vine that has borne tubers chiefly of the desired form and size, is of more value for seed purposes than is a very large tuber from a vine that has descended from a strain which habitually produces numerous small or otherwise undesirable tubers.

The system adopted by the Canadian Seed Growers' Association is, if I may borrow the words of our secretary, Mr. Newman, 'simple and practical, yet is founded on scientific principles, the individual plant being taken as the basis of improvement.' At first it was thought that as the tubers are simply swollen portions of the underground stems, that the same principles of breeding which apply in plants which reproduce themselves through the seed would not apply in those which reproduce themselves asexually, that is through parts of the vegetative system. The evidence of our best authorities on the subject do not, however, support this theory, and the individuality of different parts of the plant is now generally recognized. Interesting evidences of this are to be found in a bulletin on the 'Potato and its Culture' published in 1905 by Mr. W. T. Macoun of the Central Experimental Farm. In this bulletin he describes the methods used at the farm in the originating, developing and fixing of new varieties of potatoes. He says: 'After a variety has been originated in any of the three ways above described, (i.e., by seeds, by cross-breeding or by the selection of bud variations or sports) and after its general characteristics have been sufficiently fixed to warrant its introduction, a variety may be so changed in character, by careful selection, that it would not be recognized if compared with the original in field culture.

'This selection may be undertaken for the purpose of increasing the yield, or to obtain a variety which is earlier or later, shallower in the eye and of better shape; it may also be undertaken to obtain a potato which is more resistant to disease, better in quality or with a higher percentage of starch.

'When the variety or varieties to be improved have been decided upon the sets are planted in the ordinary way, or a little further apart, in the rows. At digging time, the best potato from the most productive hill is saved, and all the others discarded; or the best potato from the hill that is freest from disease; or the best potato from any other standpoint. This best potato is planted the following season and the selection continued until the chacteristics sought for appear fixed.'

The system adopted by the Canadian Seed Growers' Association is, briefly, as follows: An oblong plot of at least 25 rows, 8 hills in each row, is planted and each row is given a number. The plot is given the same treatment as the rest of the field, but at digging time each row and each hill is dug separately. A record is kept of the total number of tubers, the total number of diseased tubers and the total number of marketable tubers in each row. From the plot at least 25 of the best hills are selected as seed for next year's breeding plot. The product of each selected hill is placed in a bag by itself and given a number. In numbering the selected hills, if it is desired to keep a continuous record, the number of the row from which the hill is taken is placed before the number of the hill. For instance, this year I selected Hill No. 2 from Row No. 6. Next year a row will be planted with those tubers and given the number '6-2.'

In the selection of potatoes the principal points to be taken into consideration are, *productiveness, quality, shape* and *depth of eyes.*

Potatoes vary greatly in productiveness. At the Central Experimental Farm the average of six years showed a difference of 459 bushels 48 pounds per acre between the most productive, and the least productive varieties. Personally, the first year I kept a record of the Green Mountain potato I found a variation between rows amounting to 38 tubers, and this year a variation of 34 tubers. In selecting for productiveness, however, one must not overlook the fact that it is the number of marketable tubers which counts. A hill may contain a large number of tubers out of which there will come comparatively few marketable ones, while a hill near by may contain less than half as many tubers but be practically all marketable. Thus, referring to my record of selected hills I find that hill No. 1 contained fourteen tubers out of which only seven were marketable, while hill No. 2 contained but eight tubers all of which were marketable and of good size and shape. By the continued selection of the progeny of this hill the number of unmarketable tubers should be materially reduced.

We may almost say that quality is of equal importance with productiveness. All over Canada and the United States a thin-skinned, dry, meally cooking potato is demanded. Here it is interesting to note that according to experiments carried on at the O. A. C. by Prof. Harcourt, mealiness in the potato is associated with a low protein and high starch content, this being the desired condition.

Tastes differ slightly as to the colour of the skin, some markets requiring a pink skin, but as a rule a potato with a white skin is preferred. In shape the potato should be flat-round rather than round as there is then less danger of the centre being hollow- The surface should be smooth without hollows or protuberances, and with a few shallow eyes placed evenly over the surface. Mr. Macoun says: 'The economical housewife does not like a potato with deep eyes, and in this extravagant age economy should be encouraged.' But there is if possible, a better reason than this. Nearly all the protein and a large part of the starch is near the surface of the potato. If the eyes are deep or the tuber is irregular in shape the loss in peeling will be very considerable.

In conclusion let me give the results of my own work in selection as shown by the records of the last two years. As we had heard the Green Mountain variety very highly recommended for this province (N.S.), I secured a sample from the Experimental Farm at Nappan. While the yield from this sample was fairly good, fully half the tubers were diseased. But as the shape was good and the quality excellent, we retained the variety and selected the sound, medium-sized tubers and the next year found a marked decrease in the number of diseased tubers.

In 1907, the first year for which I have exact figures, 200 hills gave a total yield of 2,548 tubers. Out of this number 1,388 were of marketable size and shape and 373 were diseased.

In 1908, I may say that for various reasons our entire potato crop was only about half that of last year—200 hills giving a total yield of 1,512 tubers. Out of this number 779 were marketable and 30 were diseased.

This year potatoes were selected only from hills entirely sound and showing a relatively large number of marketable tubers.

GLEANINGS FROM FIELD WORK IN THE INSPECTION OF SEED PLOTS DURING THE SUMMER OF 1908.

By Donald Innes, Tobique River, N.B.

It is only by going through the fields of standing grain that one can fully appreciate the importance of sowing good seed. Where good clean seed was sown there was to be found a good uniform crop of grain. Where seed was sown without having received any selection or preparation a very uneven crop was to be found. Mingled with the strong healthy plants were often to be found many which were poor and sickly. What is the reason for this? The vigorous plants undoubtedly come from large plump kernels which have plenty of plant food in them to sustain the young plant until such time as the small rootlets take hold of the soil. They are also able to take more than their share of the plant food from the weaker plants which come from the smaller seed.

Another observation came to my notice in going through standing grain fields which were very badly infested with weeds in the extent to which these pests are detrimental to the growing crop. Do we as farmers realize the loss we sustain every year by not sowing good clean seed? We all admit that the Seed Control Act has done much to arouse public attention to the danger of sowing seed infested with weed seeds. This Act, together with other educational agencies has also created a demand for high-class seed. The field competitions in seed grain are also doing valuable work as they aim to increase the supply of better seed for commercial use.

Another observation which came to my notice was found in connection with our Seed Plots. For instance where seed was sown thinly it made good growth for a time when the weather was dry, but when a wet spell came stooling took place so that the crop would not mature evenly and the quality of the grain was therefore impaired. When I found a field of good uniform growth and one which was conspicuously free from weeds, I almost unvariably found that the seed had come either from a member of the Canadian Seed Growers' Association or had received some special attention for some time. A great many of the farmers had a good word to say about the work of the Association and the Seed Control Act. I found many of the members of the Association doing a good work in a quiet way by selecting and selling seed to their neighbours. Altogether I have seen many evidences of the fact that the interest of the farmers in general is being aroused in the good seed question.

PAPERS PRESENTED BY MEMBERS OF THE ASSOCIATION ON THE OCCASION OF THE FIRST ANNUAL MEETING OF MEMBERS IN THE MANITOBA DISTRICT, BRANDON, MAN., MARCH 11, 1909.

Some of the Factors which Influence the Productive Capacity of Seed.

By Geo. H. Bradshaw, Morden, Man.

A few years ago the fact of the deterioration of my grain crops, and indeed of the grain crops of the whole district in which I reside, was forced upon me. I seemed suddenly to realize that several essentials to good, plump, vigorous high grade seed had been for years gradually disappearing. A field of any kind of grain pure and true to type was hardly to be found in the district. There was undoubtedly a growing percentage of small, stunted, starved, looking heads in the fields, and when the grain was in the bin the percentage of lean grains was again strikingly in evidence.

These facts I had noted in a general way, but a full realization of the seriousness of the situation developing had not come home to me until the time I speak of, when a consideration of the whole question was forced upon me. At that time I knew nothing of the Canadian Seed Growers' Association but was working out a plan of my own to improve the quality of my seed by means of special plots. Later I noticed an article in some paper about the work of the Association and was not long in deciding that the plan outlined was just what I wanted, so I applied for membership at once. I have been working faithfully since then along the lines laid down and nothing I have done in my farming experience has given me greater satisfaction than has the improvement I have already made in the quality of my grain crops.

I have chosen to make this introduction to my subject in order to emphasize the need that existed and still largely exists for a consideration of the factors that enter into the improvement of the seed of our common crops. When I was considering how to breed up and improve my own seed I first of all began to look into the causes of the deterioration that had taken place. It was evident that lack of proper and uniform maturity, lack of care in keeping types pure, the use of seed from fields that produced uneven growth, varying from strong vigorous plants to stunted weakly plants, in addition to the general failure to thoroughly cultivate and prepare the soil were the chief causes. In short there was no systematic effort to maintain quality. The Canadian Seed Growers' Association has outlined a system that if intelligently followed, must do a great deal of good in maintaining and improving the seed of our crops.

Lack of proper maturity has been given as one of the causes of deterioration. The remedy for this has its beginning in the seed plot. Hand-selections from this plot cannot be made until the grain is fully matured. If there are immature heads in the seed plot they are passed over and only the fully ripened heads gathered. The tendency to even maturity is thus encouraged, and in time will be a characteristic of the general crop of the farm. The value of even and full maturity is quite considerable. It facilitates the harvesting of the crop by not having to start cutting it too early to prevent waste from the over-ripe part, or having to cut the immature part too soon. A field of evenly matured grain is also likely to grade higher than a field of uneven maturity. From the view point of good seed, even and full maturity are indispensable qualities.

Another benefit that results from the hand selected seed plot is purity or trueness to type. A field of grain in which probably half a dozen different varieties are growing, besides looking unsightly and unfarmerlike is bound to entail a certain amount of loss to the grower. There may be a difference of ten days or two weeks in the ripening of the different sorts, entailing a loss either by shelling or immaturity when harvested, and probably a loss in grade as well. There is no sight more pleasing to the eye, nothing probably that excites more justifiable pride in the owner of a farm than waving fields of grain absolutely true to one type, and, I think, I may safely add, there is nothing more profitable. Of late years in this province it has been too common a sight to see fields of grain containing several varieties, as well as a mixture of other grains all growing together. The system of seed plots and hand-selection is the one practical way of getting and maintaining supplies of pure seed, and the men who are carrying on this work are not only improving their own crops in this respect but are creating a supply of pure seed for the ultimate improvement of the crops of a whole district.

I have already referred to the deterioration of seed caused by lack of proper maturity, and have pointed out the part the special seed plot plays in overcoming it. But there is something more to be accomplished at the same time, namely the development of the qualities in seed known as vigour and productiveness. In any kind of live stock, he is a poor farmer indeed who does not recognize the value of a vigorous constitution in an animal. If vigour and vitality are desirable qualities in an animal they are no less desirable in a plant. It is an established fact in animal breeding that careful and skilful selection is necessary to bring about improvement.

It is coming to be generally recognized now that selection can also do a good deal toward the improvement of crops. Having once settled in his mind the ideal type of plant he wishes to produce the operator proceeds to the seed plot and selects heads of ripened grain conforming as nearly as possible to his ideal type. By selecting a given type year after year the tendency of the seed to produce that type becomes stronger A field of grain in which the heads are uniformly well filled and of good type is certain to give a good account of itself when the yield is determined. Such crops, in addition to the tribute they pay to the skill of the grower, bring him no small measure of material prosperity.

I have so far devoted this paper to pointing out some of those factors which influence the productive capacity of seed, that are encouraged and developed by means of the special seed plot. There are, however, other factors which play an important part in this work. The system of soil cultivation, and the rotation of crops that is practiced means a good deal. All the ends I have pointed out as desirable could never be attained unless the seed were planted in soil that contained the elements of fertility in available form. The soil must be brought to a proper tilth to nourish and develop to its full maturity the crop that is sown in it. Weeds must be subdued so that the moisture and fertility of the soil will not be robbed. Much also depends on the nature of the season. The amount of rainfall, the temperature, the length of the growing season and the absence of destructive natural agencies all have to do with the measure of success achieved.

THE SPECIAL SEED PLOT *vrs.* THE GENERAL FIELD AS A SOURCE OF GOOD SEED.

By W. A. A. Rowe, Neepawa, Man.

In the year 1901 I arrived at the conclusion that if it be possible to breed up a certain strain of animals, the same is possible with any variety of wheat, oats or barley. With this thought in mind, I began the improvement of Red Fife wheat, the seed being procured from the Experimental Farm at Ottawa.

I had noticed for some time that a certain piece of land on my farm was inclined to produce crops of stiff, bright straw of good length with large well developed heads of grain which would ripen two or three days earlier than the remainder of the field, and from this place, I made a selection of good sheaves. These sheaves were threshed and the resulting seed thoroughly screened for use the following year.

Now while this plan of selecting seed is a very good one, yet I found that I was not developing a desirable sort of wheat as it was composed of a variety of types. There were a few small heads, heads that were not filled at the base and heads that were light at the tip. However, by using a course screen in my fanning mill, screening out all small and undesirable seeds, I succeeded in obtaining an appreciable increase in yield from year to year. In the year 1905, I found in the standing crop bearded heads and kernels that were not peculiar to the Red Fife type.

In the Spring of 1906, I concluded that to attain the height of my ambition, I must adopt a more advanced method of producing high-class seed. I therefore made application for membership in the Canadian Seed Growers' Association and re-adjusted my methods to conform with those followed by this organization.

I am confident from my own practical experience that a general improvement can be affected by the observance of certain laws, just as surely as improvement can be brought about in our flocks and herds by the observance of the same principles.

Since 1906, I have followed very closely the rules and regulations of the Association, and have selected only well ripened, typical and thoroughly developed heads, of Red Fife wheat. This selection has been made each year in sufficient quantity to sow a ¼ acre plot the following year, the seed being threshed by hand so that the danger of its becoming mixed with inferior seeds has been eliminated.

The plot is especially prepared for the production of high-class seed, and affords a medium through which the strain may be built up in yield and quality and maintained in purity. From each succeeding plot, a hand-selection of seed is made, the balance of the plot being used to furnish seed for the main crop.

By this method the following essentials in good seed are secured, namely: productiveness, hardiness, ability to resist disease, strength of straw, quality and purity of the strain. All these can be considered in a way which is absolutely impossible where the entire field crop has to be taken into consideration. By this system of seed selection it is possible to obtain a high standard of perfection in any kind of grain.

The results I have obtained by this system are as follows:—

1. Greater yield per acre.
2. A more uniform colour in the kernel.
3. An increased price per bushel.

I have also had the satisfaction of being a successful exhibitor of Red Fife wheat for the last four years. In 1906, I exhibited in Neepawa securing first prize, and in Winnipeg at the Provincial show secured second for the best 25 bushels and third for the best 5 bushels and three firsts in Carberry. In 1907, I secured first at Neepawa, first at Minnedosa, second at Carberry, two seconds at Winnipeg. In 1908, I secured second at Winnipeg Seed Fair, December 15, and 3rd in Winnipeg Seed Fair, February

15, 1909. This is a record I am very proud of and I make mention of this not for the purpose of advertising my seed, but solely for the purpose of showing results that may be obtained by any farmer who pays strict attention to the proper selection and breeding of his seed. There are many other results that I might mention, but I shall refrain from doing so at this time.

THE OPERATING OF A SPECIAL SEED PLOT FROM SEED TIME TILL HARVEST.

By J. C. Smith, Darlingford, Man.

First choose a suitable location for the plot where the soil is uniform throughout. Prepare this plot well, but don't make it too rich. Assure yourself that no noxious weeds or other varieties of grain are left in the soil to crop up and damage or spoil your crop. Better have a small plot and have it first-class.

Selecting the Seed.

The seed for this plot should be very carefully selected from the standing crop the previous year when the crop is ready to harvest. The operator should select the heads for this seed himself, having fixed in his mind just the kind of plants and heads he wishes to produce in future. He should pick only that type of head from the best plants—plants that have strong, bright straw, bearing good sized, well formed and well filled heads. Enough of these heads should be gathered to thresh a sufficient quantiy of seed to sow the special plot at the rate of four to six pecks per acre, depending upon the locality and character of soil.

Preparing and Sowing the Seed.

The seed should be well cleaned and thoroughly treated, in the case of wheat or oats with Blue stone or Formaline as a guard against smut, and then sown two or more inches deep in the seed bed.

Attention to the Plot.

Attention should be given the plot throughout the growing season and comparison made with the general crop, which has an equal chance, note being taken of the improvement that is being made in the strain. As the grain begins to ripen, go carefully through the plot and pick out any plants that appear to be of a different variety. I believe by persevering in this way, year after year, that our standard can be raised twenty-five per cent or even more. When the crop is thoroughly ripe, the selection of 25 to 30 pounds of heads should again be made, in the same way as described above, for the next year's plot and this selection continued year after year in order to maintain the purity and high standard of the strain.

Harvesting and Threshing.

Let the crop ripen thoroughly before harvesting as the seed will be much stronger and better. If possible, thresh this crop by hand, keep it away from the threshing machine unless you have one of your own and can clean it properly. Although a necessity, I have learned to regard these large travelling machines as very dangerous in the way of mixing our good clean grains and for spreading noxious weeds.

SOME RESULTS OBTAINED THROUGH THE CAREFUL SELECTION OF SEED.

By Geo. Dow, Gilbert Plains, Man.

I first became interested in seed selection through the Macdonald-Robertson Seed competition. I was a competitor in the oat class, and though not making so good a showing as some of the others, was fortunate to be among the prize winners. At the close of the competition I became a member of the Seed Growers' Association. Later my brother joined me, and we have since carried on the work together.

It has never been our practice to select large heads indiscriminately and without regard to type, or to the development of the stolons. We have noticed that many of the largest heads and those which first catch the eye, are borne on plants having but a single stalk. These we have always avoided. Our practice has been to search for the largest and most vigorous plants, those which have stooled well yet have the stalks evenly developed. From these we select the best heads, having regard to size and type. The result of this system may be seen in the increased vigour of the growing grain and in the uniform stand of the crop. The seed germinates more quickly, and grows faster. The blades are broad and strong rapidly taking on a rich, dark colour. The plants develop evenly and the heads are more nearly true to type. It is shown as well in increasing yields. We kept no records of the yield per acre during the Macdonald-Robertson competition. Some of the results we have since obtained, however, are as follows:— The yield of Improved seed of Banner oats in 1903 was 27·5 bushels per acre. In 1904 the crop was partly destroyed, so a fair estimate of the yield cannot be given. In 1905 the yield was 55·4 bushels per acre. In 1906, 76·2 and in 1907, 65 bushels. The season of 1903 was very dry, and the plot being sown on land which had been worked for a number of years, the yield is lower than it would otherwise have been. Since then the plots have been on new land, and weather conditions have been more favourable. As the three seasons last mentioned were as much alike as could be looked for, the yields give a very fair test of the results of selection. That they do not show a continuous increase of yield is only due to the fact that in 1907 a part of the plot was too wet.

The yield of General Crop Seed in 1905 was 66·2 bushels, in 1906, 77·4 bushels, and in 1907, 78·4 bushels per acre, a steadily increasing return. A part of this plot was also rather wet in 1907. These yields have all been obtained on light sandy land.

The yields for 1908 are not given, the spring being much too wet, while a severe period of drought occurred during July and August. The returns, therefrom, do not give a fair test of the results of our work.

We have not yet done work enough in the selection of wheat to give definite results from our seed plots, although we obtained a yield in 1906 of 35·25 bushels per acre, compared with 22·2 bushels in 1905.

Aside from the results of the work on our special seed plots, we have other evidence of the good effects of selection. We have sold considerable quantities of seed locally and have yet to hear of any one who has not received increased returns over ordinary seed, or who was not satisfied he had made a profitable investment. An instance may be given of a certain grower who purchased a quantity of Red Fife—the product of Registered Seed. This was sown alongside of seed of his own growing. The result showed there to be a difference of eight bushels per acre in favour of the selected seed.

A striking instance of the results of selection is found in a test conducted by the Experimental Farm at Brandon during the past season. A plot of our 'General Crop Registered Seed' was sown for comparison beside a plot of ordinary seed. The yields were 113 bushels and 13 pounds from the Farm seed, and 119 bushels and 19 pounds from the Registered Seed. While it may not be fair to take the result of a single test as conclusive, yet we have no doubt that further trials would give like results.

A notable change has taken place in our Banner oats since selection began; at first there was a decided tendency to shell in the upper part of the head, while the kernels in the lower part were still rather green. This has now disappeared, whether as the natural result of the increased vigour of the plants or because we have not selected such heads, it cannot be said.

Of the difficulties with which we have to contend, the most serious is the keeping down of noxious weeds, especially wild oats. These pests are so widely scattered that it is difficult to keep clear of them. Great care is also necessary to prevent mixing while threshing. We have found, though, that threshers are very willing to help a good cause, by cleaning out their machines as much as possible between small lots.

In this way, and by threshing these in proper rotation with large ones we have kept our lots free from other grains.

In the oats we have met with a tendency to produce increasingly large awns. A few heads were found in the seed plot last season having the large twisted awns of a wild oat, though showing no other resemblance to these. We are in doubt as to how far this may be considered unfavourable. The kernels in these heads are among the largest, and are quite as plump as any we find. Another thing I might mention is the difficulty in getting the seed properly cleaned. We have tried several different fanning mills but none of them do satisfactory work under all conditions, though they are all right for ordinary cleaning.

Selection of seed leads to cleaner and better methods of farming through the necessity of keeping seed plots clean, and the object lesson provided in the greater returns obtained through the operation of such plots. A sharp lookout must be kept for noxious weeds whenever they appear. The habit of close observation resulting from the work of selection is a great aid in this, as it helps one to recognize these intruders more quickly. The results of this affect not only those who are directly engaged in the work of selection, but also those who may be observers of this work, and those who purchase selected seed and thus gain some of the advantages for themselves. When we first began the work, the idea of selecting heads out of a field by hand, was regarded by some with a good deal of amusement. These people have since had reason to completely change their opinion and we have sold quantities of seed locally at prices considerably above the ordinary price. The effects of this were shown at the local seed fair held last month. All prizes in the class for Red Fife wheat and white oats were taken by the produce of our seed. The exhibits of Red Fife were greatly increased over previous years and with one exception were from the same seed. The exception proved to be the lowest scoring of the lot. This has had the best possible effect in stimulating interest in the work of the Association. It has also had an influence on those who, because of several backward seasons, were becoming doubtful of the advisability of sowing Red Fife wheat in our district.

We have found the work to be very interesting and productive of good results in the way of stimulating a greater interest in the general work of the farm, a closer observation of plant life, and a study of the different methods of propagation and improvement.

SOME RESULTS OBTAINED THROUGH THE CAREFUL SELECTION OF SEEDS.

By T. Turnbull, Manitou, Man.

I commenced in 1907 with 100 pounds of General Crop Registered Seed, grown by Mr. Thomson, of Roden, Man., but on account of the late spring, the earliest possible date I could sow was May 10. I closed alternate spouts in the drill and sowed nearly two acres, the sowing being done both ways. It stooled out splendidly but the combined rainfall for June and July was only one-tenth of an inch in our district and on August 2 we had a frost which froze the crop on the lower lying portions of the plot. I harvested September 6 and threshed 38 bushels from the 100 pounds sown which I considered exceptionally good under these conditions.

Very little rain fell during the fall of 1907 and the spring of 1908 was also very dry. I sowed on April 10, in 1908, just one month earlier than in the previous year, 23 pounds of hand-selected seed, and nine bushels of General Crop Seed. We had a good rain on June 18, but after that a season of drought set in which continued until after the crop was cut. Between lack of rainfall and hot winds the yield was much reduced and several patches became burnt out in my field before the heads were filled. I cut on August 21. From the 23 pounds hand-selected seed, I threshed by hand 7½ bushels and from the 9 bushels General Crop Seed I had 181 bushels machine measure from 6 acres, or over 30 bushels per acre. On none of the adjoining farms was the yield over 17 bushels per acre, so that the difference I attribute largely to the productivity of the selected seed.

The method of sowing practised I believe to be an adventageous one, particularly in a dry year as the plants are distributed more thinly over the ground, and do not require so much water. I will not say that this was not a factor in producing the extra yield. The feature of the crop, however, was the length of the head which was quite noticeable, the special crop correspondent of the 'Free Press' making particular reference to it when describing the crops in the district. Personally, I need no further proof that we obtained, through the careful selection of seed, an increased yield with an increased value on account of the capability of the seed to reproduce a productive strain; and I see no reason why yields that would now be considered fabulous may not become quite common, under favourable conditions of growth and soil fertility, by simply continuing the process of careful selection. When we consider what selection has done for the improvement of live stock, and the comparatively short time that the principle has been applied to plant improvement, and note the progress that has been made in that time, I do not think one need be called unduly optimistic to look for such yields during the lifetime of some of us present. I think we might make this the slogan of the western branch of the C.S.G.A.; with abundant faith in its ultimate attainment such a goal should furnish an additional incentive to continue the good work.

THE SCOPE OPEN FOR THE PRODUCTION OF HIGHLY BRED SEED IN MANITOBA.

By Mr. John Mooney, Valley River, Man.

It gives me very great pleasure indeed to be present at this, the first meeting of the members of the Canadian Seed Growers' Association in Western Canada. This Association stands for all that goes to influence the production of maximum crops of highest quality in this country, thus placing a high premium upon efficient work and labour intelligently applied.

To-day I propose to review briefly the conditions which exist in this western country at the present time and to endeavour to show to what extent we, as growers, may profitably engage in the production of high-class seed for the western trade. An examination of the grain which is coming from the farms of Manitoba reveals a condition which is most alarming. Seeds of noxious weeds are found to an extent which augurs ill for our western agriculture unless more stringent measures are taken to keep these pests in check. The presence of weeds on our farms and in our grain involves an annual loss of thousands of dollars. Not only do they rob the land of that food which should go to develop the blade and the ear and later, 'the full corn in the ear,' but they draw enormously on the supply of moisture in the soil which in many sections is quite as detrimental as is any loss of plant food. Then again their presence in a crop requires much useless labour in handling, twine in binding, the expense of cleaning and too often involves the uncertainties associated with 'docking.'

Another matter with which we must deal is the purity and uniformity of the variety. On many farms varieties are badly mixed with other sorts, which condition results in an uneven grade. Lack of uniformity, due either to a mixed variety or to want of proper selection of the seed, results in uneven maturity of the crop which likewise means an uneven and lower grade. In certain northern districts there is a large field open for the development of better early maturing strains and varieties. These are problems which the grower himself can do much to solve on his own farm if he will but apply himself.

While much can be done by the more universal practice of better systems of rotation of crops and better cultural methods generally, yet the remedy for the most glaring evils of the present day is to be found in *better seed.* In purchasing seed in the past, we have had as a general thing no guarantee as to the purity of the variety or of its producing power. When we consider the appalling extent to which these things have been ignored is there any wonder that we are face to face with so serious a problem? The phenomenal rate at which weeds and foreign varieties will multiply if allowed to go to seed is a matter which is already well known to the observant and thoughtful grower. Since contamination already exists stringent remedial measures must be taken while strict preventitive action must likewise be resorted to.

The solution of a problem such as this demands that an energetic educational propaganda be conducted throughout the country districts in order that the people may come to learn what good seed is and what it means. Among the more effective mediums through which to emphasize the importance of these things special reference should be made to the seed fairs. During the present year we have had no less than twenty-seven of these fairs in this province and I appeal to the members of this Association to do all in their power to help along these valuable institutions. As an Association we have satisfactory evidence that we can increase the yield of our grain crops by from four to twelve bushels per acre by the use of good seed. Such an increase would mean millions of dollars annually to this province.

The demand for good seed is increasing from year to year which fact would indicate the growing importance which is being attached to the use of such seed. With this growing demand the future of the trade in high-class seed becomes brighter and more encouraging and we as members of this Association have a splendid opportunity not only to contribute our share toward the improvement of western agriculture but to engage in a profitable business. The production of high-class seed is an enterprise in which 'pelf and patriotism' are not antagonistic.

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